WORLD PETROLEUM

OCTOBER 1958

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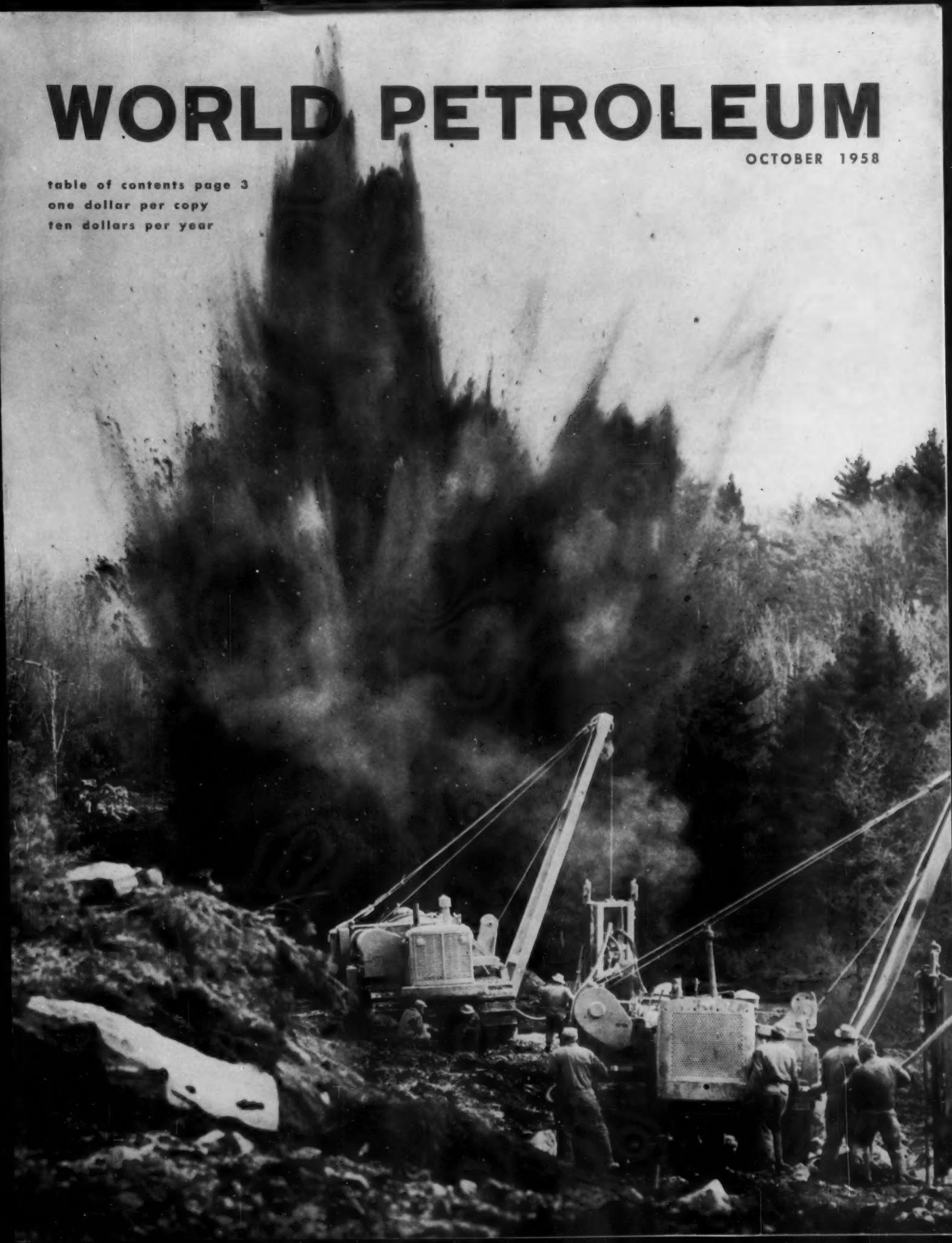

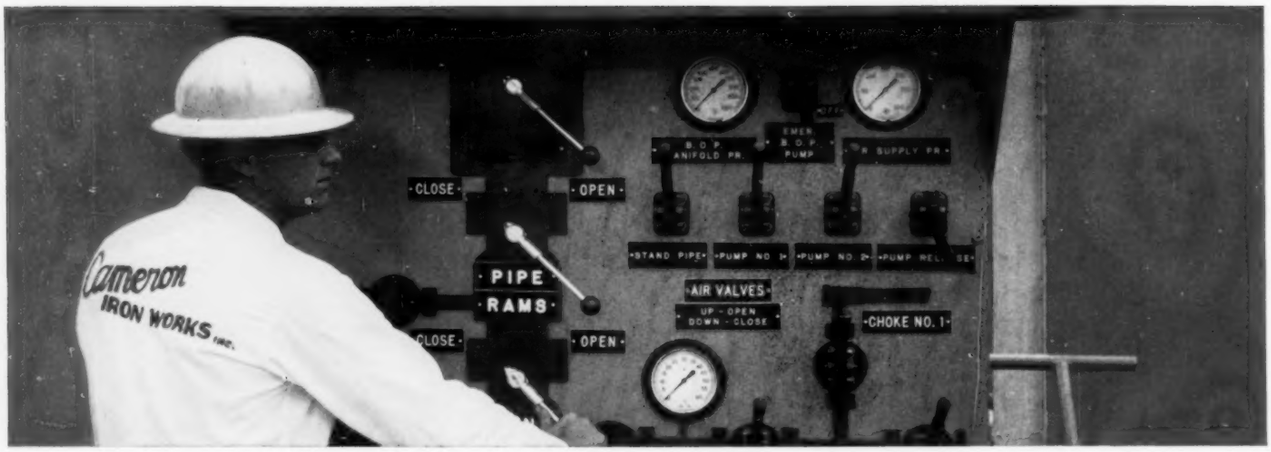

PRESSURE BALANCED

New Preventer Controls Well Pressure Without Fighting It

Well pressure does not affect operating pressure in the Cameron Type "F" Blowout Preventer. In conventional preventers a large part of the required operating pressure is used to overcome well pressure. Ram operating rods act as pistons working against the operating system. This counteracting force is in direct ratio to the cross section area of the rods acted upon by well pressure. But with the exclusive pressure balanced design in the Cameron Type "F" preventer, low friction ram packing is the only force which must be overcome.

This, of course, means that far less operating pressure is required, and a variety of operators can be used (we offer three interchangeable units – hydraulic, pneumatic, and manual).

Check the following advantages in the new Type "F" – you'll understand why our best salesman is the preventer itself.

Ram packing is self-sealing and self-feeding, with a big reserve of tough oil-resistant Hycar rubber. These packing elements are built to take the rough treatment they are bound to get.

Arms and rollers operate in Tee slots to close and open rams. Design geometry produces fast movement until rams engage pipe (or each other in blind application), at which point movement speed is reduced and sealing pressure is tremendously increased.

Compact hinged bonnets allow easy access for simplified ram changing. When fully retracted the roller and arm assemblies drop free of the rams. Ram bores are relieved toward bonnets to ease ram removal.

Transverse ram shafts are pressure sealed at both ends affording "balanced pressure" operation. Shafts rotate – do not pull abrasives into seals as with sliding rods.

New simplified operators are attached to one side only.

Operator can be removed and overhauled or replaced while drilling with no loss of rig time.

Consider your operating costs, your rig investment, and, of course, the safety of your personnel – your best investment in security and economy is the Cameron Type "F" Blowout Preventer – the best design that research and experience offer today.

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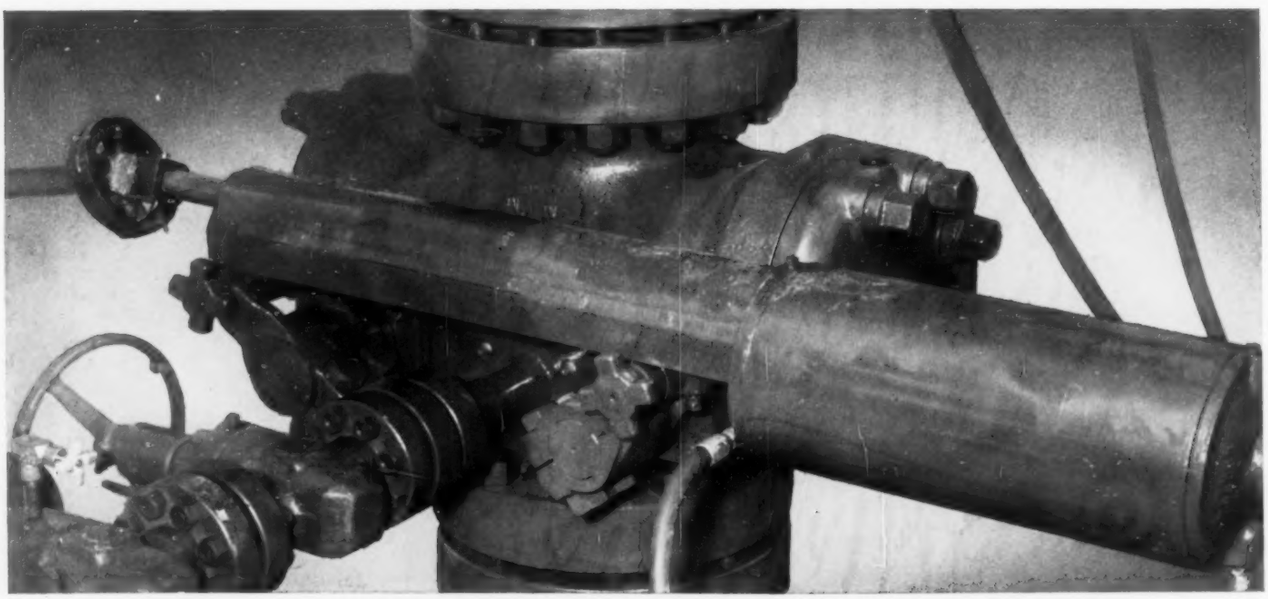

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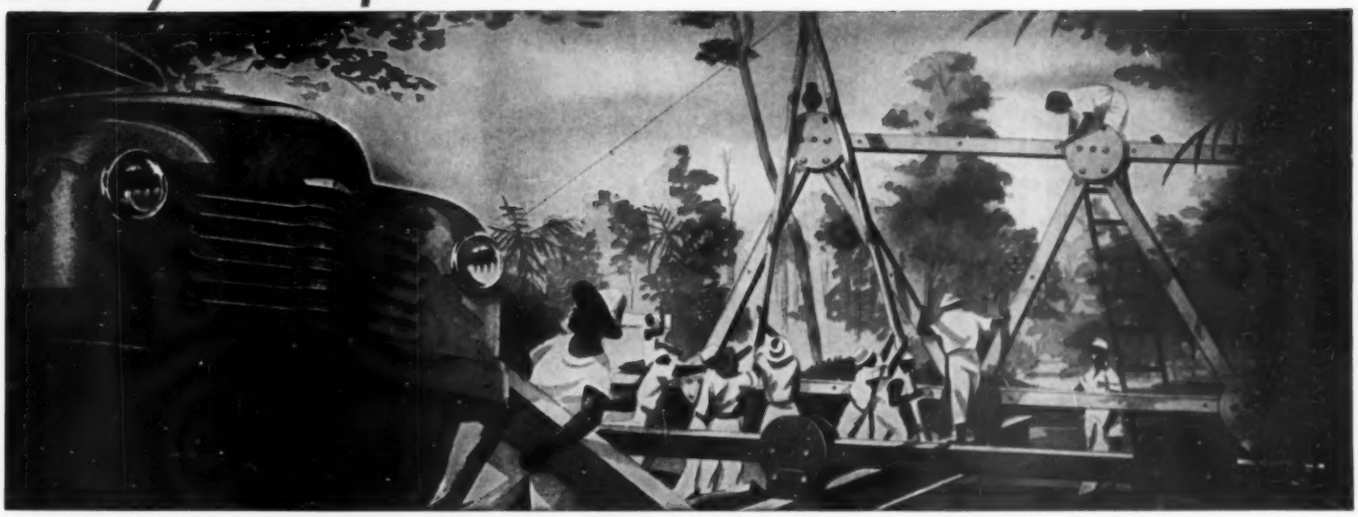

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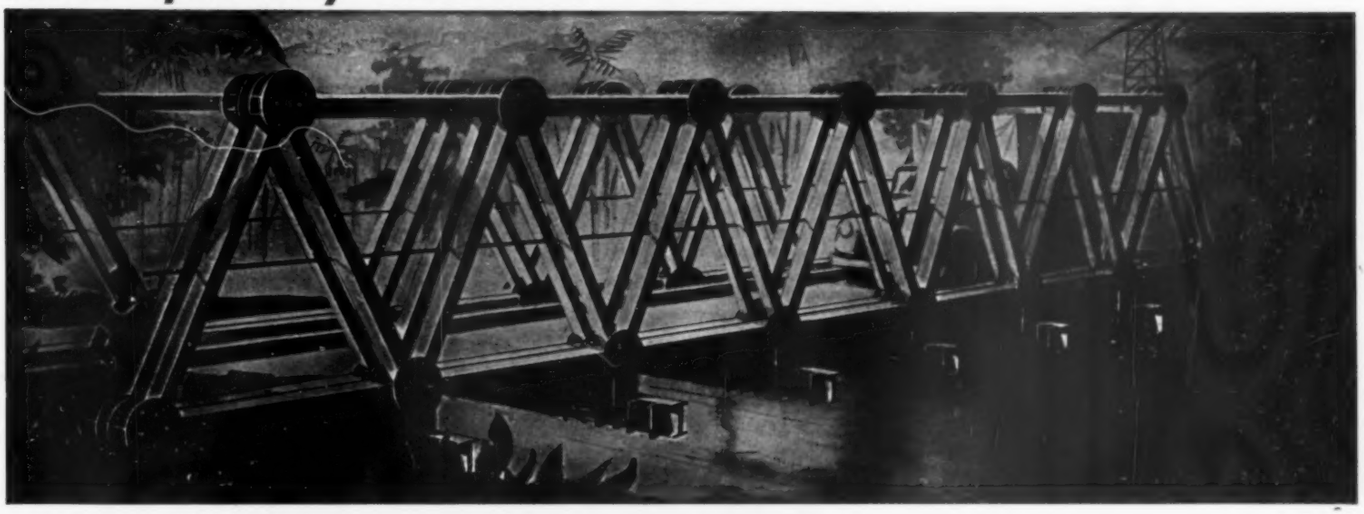
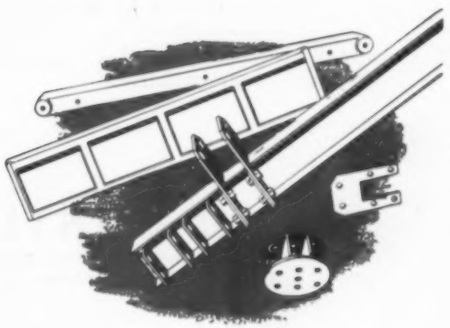


remote up-country sites

Butterley Standard-Unit Bridges are in use all over the world where transport is difficult, skilled labour scarce or where site preparation has to be carried out under adverse conditions. From five standard units, all sizes of bridges can be built; the units can be sent by any form of transport; site erection is remarkably simple and swift with an absolute minimum of equipment.



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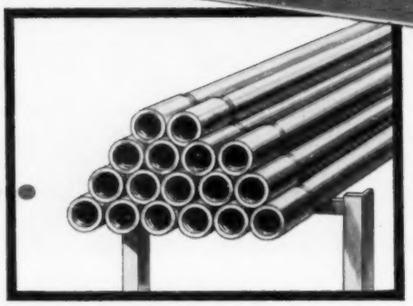
Pipe...



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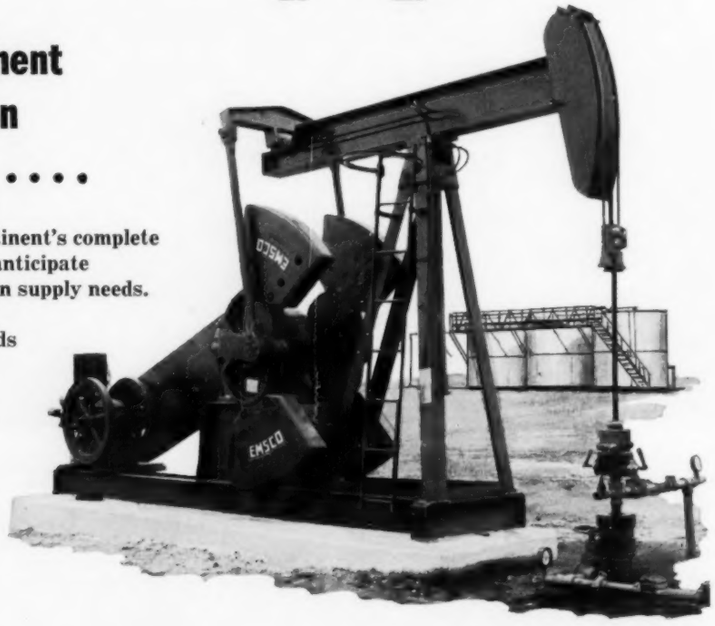

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World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

Trans-Canada's constructors blast their way through rough country as the pipeline rushes toward November gas at Montreal burner tips. Photo is taken from The Tie-In, house magazine of the H. C. Price Co., Pipeline Constructors, Bartlesville, Okla.

LUMMUS

ENGINEERS AND CONSTRUCTORS

385 Madison Avenue

FOUR NEW DESULFURIZER-CATFORMERS PART OF BRITISH AMERICAN OIL CO.'S QUALITY IMPROVEMENT PROGRAM

Lummus Now Building Fourth Unit: Has Handled All B-A Catformer Construction Since 1954

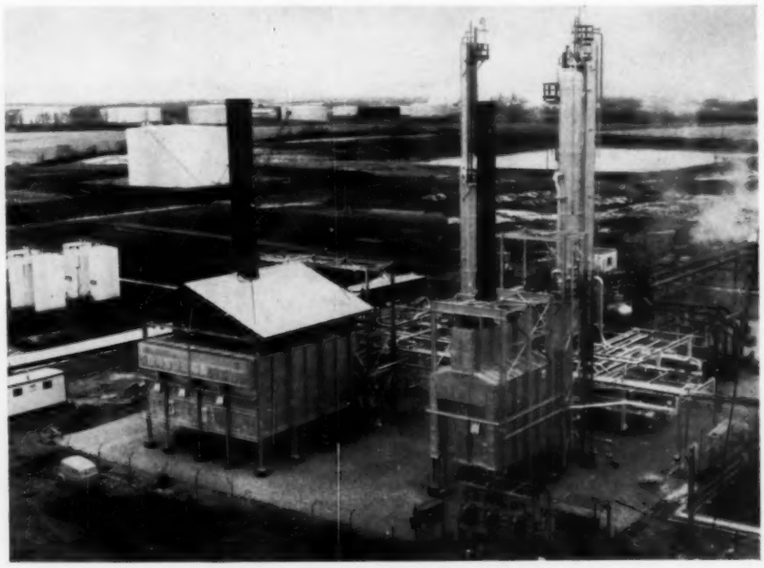
Since 1954 the British American Oil Company has authorized several million dollars worth of desulfurizer-Catformer units at four refineries throughout Canada as part of their quality improvement program, which is designed to produce a higher octane gasoline for industrial and consumer use.

These facilities, engineered and constructed by The Lummus Company Canada Limited, have been completed at Montreal East, Quebec; Clarkson, Ontario; and Edmonton, Alberta. A fourth facility at Moose Jaw, Saskatchewan has been awarded to Lummus and is scheduled for completion by October, 1958.

The Edmonton Catformer, with a capacity of 5,400 B/D, cost

Montreal-East Catformer has 13,000 B/D capacity. Cost is $2 million. Completed early 1955.

Clarkson, Ontario Hydrodesulfurization Catformer cost $2,300,000, has 10,000 B/D capacity. Completed summer of 1957.



Shown is the record-breaking Catformer construction job at Edmonton, Alberta for The British American Oil Company. Completed in mid November 1957, this is the third Catformer engineered and constructed by Lummus for B-A. Since then a fourth unit to be completed by October 1958 is under construction for B-A by Lummus.

FOR INDUSTRY

New York 17, N. Y.

$2,100,000. The Unit was completed on November 15, 1957, and accepted by B-A two weeks later. It was finished in record time—exactly five months after the Lummus superintendent arrived at the site and 11 months after the contract was awarded. Acceptance by the customer was on December 3, 1957.

A potentially crippling snowstorm at the site in early October was anticipated by Lummus field engineers, who had temporary steel supports erected over the exchanger and piping areas. When the snows came, tarpaulins were thrown over these supports and the work continued uninterrupted.

The new Moose Jaw, Saskatchewan unit will be similar to the Edmonton Catformer and will also have a 5,400 B/D capacity. Construction began on May 1, 1958 and will be completed by October 1, 1958.

Over 800 major installations have been designed, engineered and built by Lummus throughout the world in the last half-century. Put this experience to work for you when you plan new facilities.

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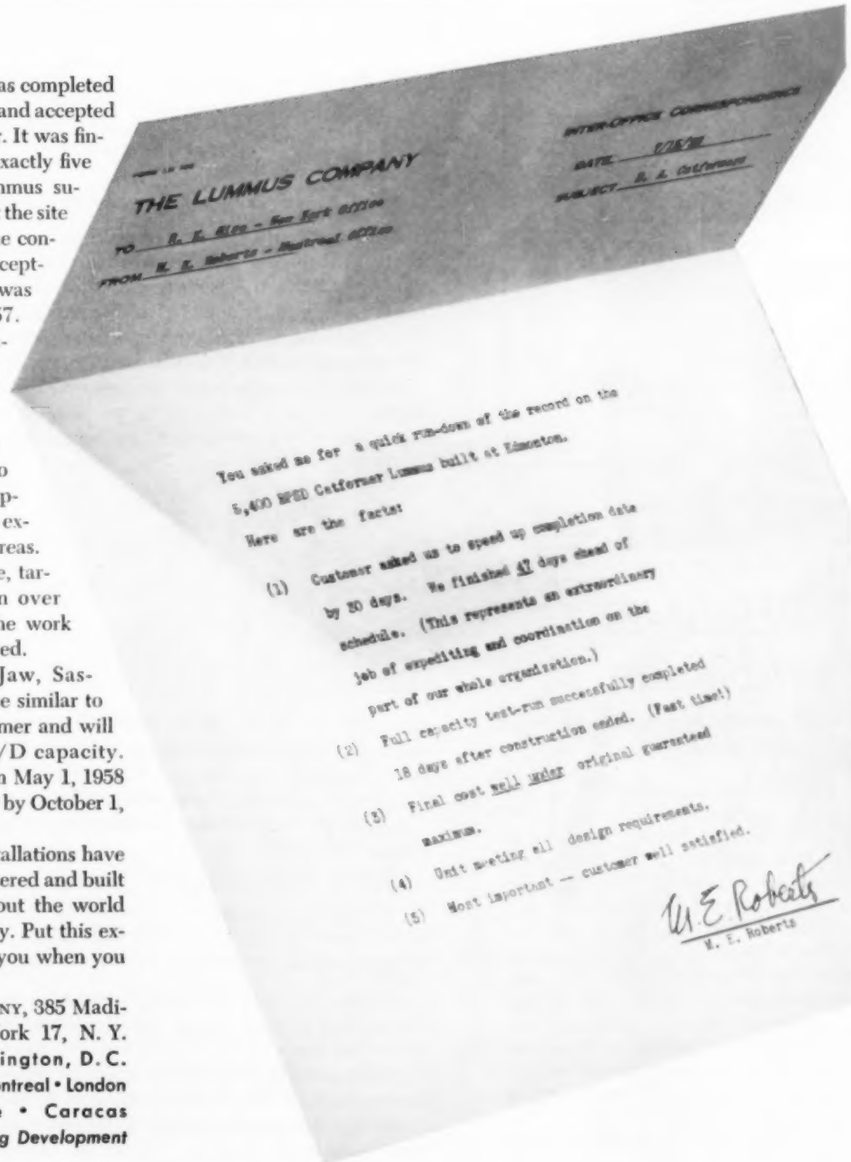

THE LUMMUS COMPANY

INTER-OFFICE CORRESPONDENCE

You asked me for a quick run-down of the record on the 5,400 BPSD Catformer Lummus built at Edmonton.

Here are the facts:

(1) Customer asked us to speed up completion date by 30 days. We finished 47 days ahead of schedule. (This represents an extraordinary job of expediting and coordination on the part of our whole organization.)

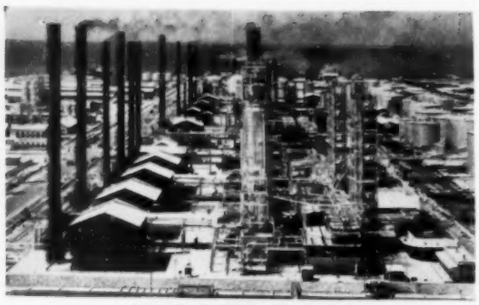
(2) Full capacity test-run successfully completed 18 days after construction ended. (Fast time!)

(3) Final cost well under original guaranteed maximum.

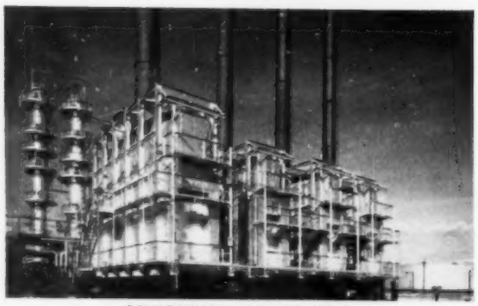
(4) Unit meeting all design requirements.

(5) Most important — customer well satisfied.

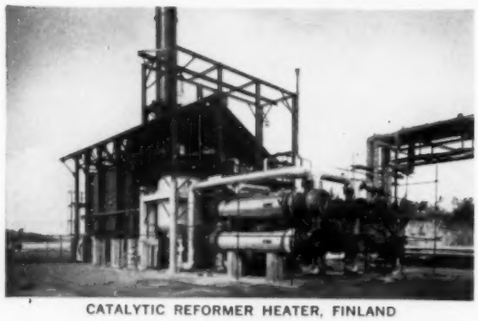
W. E. Roberts



CRUDE HEATERS, VENEZUELA



SOVAFORMER HEATERS, U.S.A.



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Lummus Oil Heaters are sold world-wide

Custom-Designed in New York, Procured Internationally, Payment can be made in Local Currency

Whether for petroleum refineries, chemical or petrochemical plants, Lummus will design, engineer and construct your next heater installation—regardless of size or type—for any major process, around the world.

Lummus heater services are made available on three bases: 1. engineering only; 2. with all material delivered to job site; and 3. completely erected.

Lummus horizontal tube or vertical tube oil heaters, of both special and standard design, range from 100,000 to 300,000,000 Btu per hour. In the last 25 years, the combined capacity of Lummus oil heaters purchased has exceeded that of any other company in the world.

As illustrated above, neither size nor location of the unit presents a problem to Lummus. These units are designed and engineered by the Lummus New York staff, who put the full benefit of their accumulated years of experience into each job. Procurement is made through the nearest of the five Lummus international group of companies and the cost of the job is payable in the currency of the country in which the procurement is handled!

Consult with Lummus on your next oil heater.

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OIL HEATER DIVISION
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CHICAGO, WASHINGTON, D. C., HOUSTON, MONTREAL, CARACAS, MARACAIBO, LONDON, PARIS, THE HAGUE

Washington

By Joseph B. Huttlinger

New Oil Import Program

A new system of allocating crude oil and unfinished oil imports on the basis of refinery runs rather than historical importing patterns has been proposed by Capt. Matthew V. Carson, Jr., Administrator of the Voluntary Oil Import Program. Captain Carson has invited interested parties to comment on the proposal within 30 days of publication.

Under the new proposal, over-all level of allowable crude oil imports would be computed on the basis of total demand—both domestic and export—rather than on the rate of domestic crude oil production now used. The proposed over-all level would be 10.1% of annual total demand, as estimated by the Bureau of Mines. A transition period of one year would allow authorized importers to adjust their operations. Prior to January 1, 1959, current allocations on crude and unfinished oils would remain in effect, and no action would be taken on requests for increased or initial allocations.

The following methods would be utilized in computing individual allocations until the new program completed a year's transaction period on January 7, 1960:

1. *January 1, 1959-June 30, 1959*—New importers and current importers whose allocations are less than 6% of individual reported refining capacity would be granted allocations equal to 6% of such capacity. Those whose allocations are greater than 37.5% of reported refining capacity would be reduced to that level.

2. *July 1, 1959-December 31, 1959*—Refiners with less than 9% of refinery runs for the year ending March 31, 1959, would be increased to 9%. Those with the highest percentages would be progressively reduced to raise the others to 9%.

3. *January 1, 1960—Each Six Months Thereafter.* The allocation of all importers will be the percentage that the total of all allocations bears to the total of refinery runs for the year ending three months prior to the effective date of the allocation. For example, if the allowable level of imports equaled 11.4% of refinery runs, each refinery could receive 11.4% of their refinery runs in oil imports.

The proposal provides that no importer may import more than 10% of his allocation in unfinished oils, and special provisions are included to assure an adequate supply of asphalt for the Federal Interstate Highway Construction Program.

Allocations would not be transferable or assignable, and all imports must be entered and reported through customs by the holder of the allocation.

Other provisions of the proposal deal with: allocations for new or expanded refineries; inability to secure adequate sup-

Pipeline

plies of domestic crude oil; ownership of refineries; closure of refineries; reduction and elimination of current allocations where refining capacity does not exist; failure to report imports; and offshore refineries.

Today's proposed program would pertain primarily to Districts I-IV, although the report indicates that these methods may be extended to District V later, taking due cognizance that West Coast factors may necessitate different percentage levels.

Congress and Oil

The American petroleum industry, which used to win most of the major things it sought from the US Congress, faced trouble in the 1958 session, which closed August 24. An attack on the depletion allowance indicated a big increase in opponents of the rate. A total of 35 senators went on record to shave it down to 15% from 27.5%. This was nearly four times as many as in 1951. Senators showed a marked disfavor over giving the depletion to US oil operations outside the USA, but Treasury Department said if the rate was lowered on foreign operations, foreign governments would find a way to increase their take so there would be little new tax income to the USA.

Congress did pass a number of bills of interest to oil and gas, including:

1. Foreign-trade act was extended for an unprecedented four years, with authority to continue the "voluntary" oil import program. Extension measure aims to tighten curbs on imports of oil and other commodities, and directs attention to finished-oils imports as well as crude.

2. Excise taxes on transportation by rail, truck, and oil pipeline were repealed.

3. Alaska was granted statehood, paving way for what could become the biggest oil rush of the past half century, and Congress passed legislation opening up inland federal navigable waters.

4. A law passed gives Congress itself veto power over withdrawals of areas of more than 5,000 acres by military departments, and another law forbids oil exploration by the military except on naval petroleum reserves.

Bills studied but not enacted are: (1) Bill calling for advance notice to Department of Justice of mergers when the combined assets of the two corporations are $10 million or more. (2) S. 11, an antitrust measure to overturn the US Supreme Court's finding that good-faith meeting of competition is a complete defense to a charge of price discrimination. (3) A measure setting up a $224 million helium-conservation program, with construction of at least 12 government extraction plants along private natural-gas pipelines.

$250,000,000
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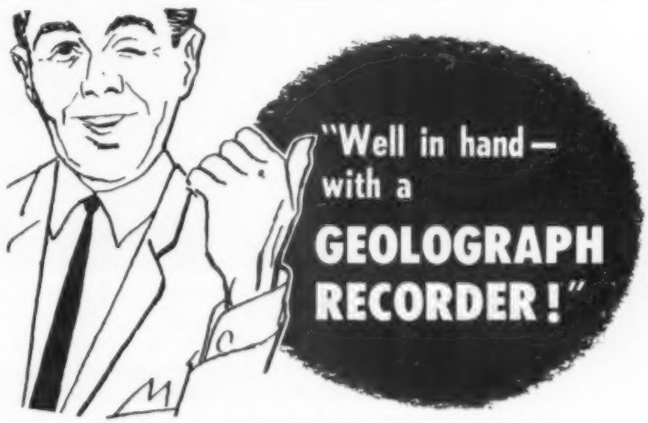

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C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Assistant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

No lubrication problems in 8 years of operation

Since 1949, twenty-seven gas engine-compressor units developing 39,985 horsepower at the Goldsmith plant of El Paso Natural Gas Company have been thriving on Gulf Security Oil. Bearing, ring and cylinder wear maintenance records have been excellent.

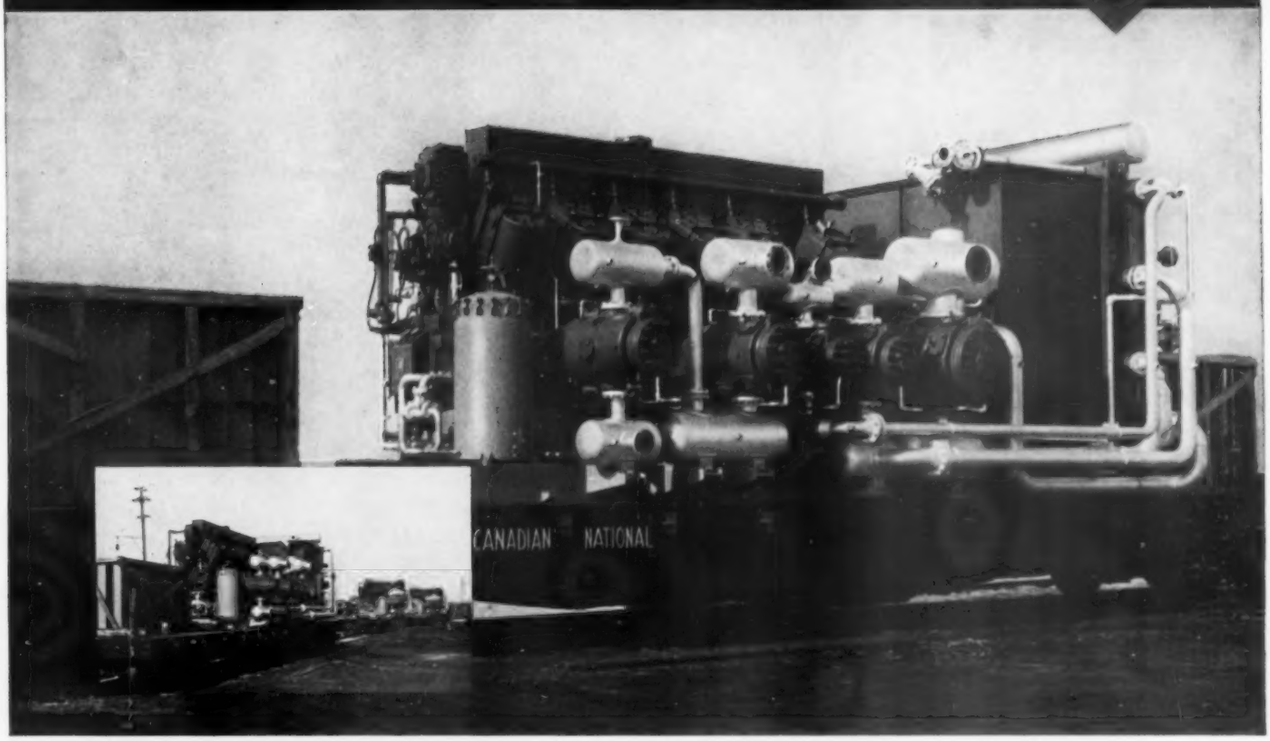
Insure safe, more effective lubrication protection for *your* compressor units. Specify Gulf Security . . . the high quality, straight mineral oil. For full information, call your nearest Gulf office.

GULF

GULF OIL CORPORATION, Dept. DM, Gulf Building, Pittsburgh 30, Pa.

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



CANADIAN BUILT Beaird-Ingersoll-Rand, 660 h.p. 12SVG packaged compressor units have Young radiators with up-draft air discharge. Interstage gas, engine water and lubricating oil cooling sections are built into the radiator. Other sizes from 120 to 660 h.p.

Beaird Packaged Compressors—

MADE IN CANADA

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another AMF product
PACKAGED
COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

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These three 660 h.p. Beaird-Ingersoll-Rand packaged compressor plants are among the first 18 Canadian-built units to be delivered by Beaird International, Inc., Calgary. This new Beaird subsidiary offers Canadian producers complete sales, service and available manufacturing facilities.

Designed for a major oil company, the units will serve a dual role in gas processing and boosting. Three stages will be used for gas boosting and two stages will handle propane for the chilling process. Another example of the flexibility possible in solving gas production problems, these compressors reflect Beaird's years of design and field experience.

With Canadian facilities, Beaird International offers a single source of responsibility from initial quotation to field service. Beaird offices in Caracas, Venezuela serve South American markets.

Wherever oil or gas is produced, there are skilled Beaird gas engineers to assist in finding an economical solution to your special operating requirements.

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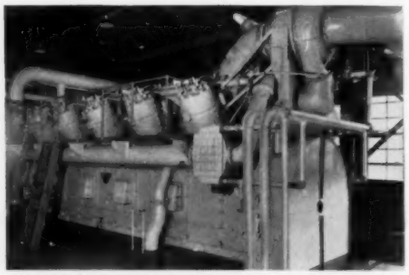
Trans-Canada moves

BEING INSTALLED . . . V-angle GMWA-10 units lined up on foundations of one of three Cooper-Bessemer equipped Trans-Canada stations.



THE GMVC-10 . . . latest type Cooper-Bessemer series turbocharged V-angle compressor of the type now being installed at Trans-Canada's North Bay Station.

Dependable, efficient

COOPER-BESSEMER

turbocharged compressors bring peak economy to the Trans-Canada system

up the horsepower

ON THE DOUBLE . . . a Cooper-Bessemer 2500 bhp GMWA-10 compressor unit, one of five for the Winnipeg and Port Arthur stations, heads for location, moved by two trucks.

As the world's biggest pipeline nears completion in Canada, compressor system plans have already been expanded to meet mounting demands for gas. Progressive Trans-Canada Pipe Lines, Ltd. is moving fast to get adequate horsepower on time, and is moving carefully to provide *proven* dependability and efficiency as well as simple means of further expansion as required. Cooper-Bessemer is proud of its part in this huge project.

Three of the line's six compressor stations are being equipped with modern Cooper-Bessemer V-angle compressors. At the North Bay Station, three Cooper-Bessemer *series turbocharged* V-angles will provide today's optimum horsepower per unit size—actually 40% more horsepower than their predecessors of the same bore, stroke and speed. The other two stations, Winnipeg and Port Arthur, will have a total of five of the largest type Cooper-Bessemer V-angles, now normally aspirated to fully meet initial demands, ***but easily, quickly converted to Cooper-Bessemer series turbocharged operation,*** for 40% ***more*** horsepower in the same space, whenever increasing demands dictate!

Cooper-Bessemer, the first in America to turbocharge heavy-duty engines, the first to provide the maximum, long-range economies of simple conversion flexibility, offers unequalled experience in meeting today's compressor needs. We are always at your service.

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LONDON LETTER

By A. L. Paget

Kent Refinery Expansion

The alkylation unit in the £30 million expansion project at British Petroleum's Kent refinery in the Isle of Grain has just been commissioned, pioneered by BP. When other equipment in the "avgas" range is commissioned soon, high-grade aviation gasoline will be produced at Kent refinery for the first time. Some 130,000 tons of this grade of gasoline will be produced annually, thereby saving an estimated overseas dollar expenditure of nearly $8 million. Already the refinery is operating at its new annual throughput of more than seven million tons of crude against pre-expansion rate of 4½ million tons.

BP In Canada

Work is progressing on the early stages of the BP refinery at Montreal. Two of the 14 storage tanks are completely erected and ready for water testing. Excavation of five main roads on the site is complete, and all pipe for the pipe route linking the dock area to the refinery site has been cleaned, primed, coated, and wrapped, and will shortly be laid.

Aircraft Fueling At Lisbon

The inauguration of BP aviation service's new hydrant system for aircraft fueling at Portela airport, Lisbon, was attended by the Portuguese Ministers of Communications and Economics, President of BP's marketing company in Portugal (Dr. Alexandre Pinto Basto), and other Portuguese notables. The new hydrant system, designed for a fueling rate of up to 1,200 gal per min, has been installed to meet the requirements of modern jet aircraft. Portela airport is expected to become an increasingly important point for intercontinental air traffic, and very high-speed fueling will be required by the "super-jets" on these routes. The system includes six underground storage tanks from which fuel is pumped through a twin 8-in. pipeline to hydrant points beside the parking apron, and thence by mobile dispensing units into the aircraft. Elaborate microfiltration-water separation is provided throughout the system.

Boiler Design

A new booklet has been issued by Cochran & Co. Ltd., Annan, Dumfriesshire, Scotland, describing and illustrating recent improvements in vertical multitubular boilers. It is of interest that the original sketch of the Cochran boiler, drawn by Edward Crompton, was for many years an exhibit at the Science Museum in London. The main novelty was the introduction of horizontal fire tubes into a vertical cylindrical shell by means of flanged tube plates, a description being published in *The Engineer* and *Engineering* in 1878.

Kuwait's New Airport

His Excellency Shaikh Fahad as-Salim As Sabah, president of the Development Board and Public Works Department of Kuwait, has appointed Frederick S. Snow and partners as consulting engineers for the development of the new Kuwait international airport, under the direction of Fuad Abdel-Baki, inspector-general of the public works department. The airport is planned to be Class A-1 International Civil Aviation Organization standard for 24-hour use. Terminal control and maintenance facilities will be to international standards. Construction is expected to begin in 18 months.

Tanker News

Hawthorne, Leslie (Shipbuilder) Ltd. announce successful completion of her trials by the single-screw tanker "Denby Grange" and of her subsequent handing over to Houlder Line Ltd. The vessel is about 18,000 dwt.

The single-screw motor tanker, "Stancloud," for the Stanhope (Overseas) Shipping Co. Ltd. of Bermuda, was launched in July at the Neptune Works, Newcastle-upon-Tyne, of Swan, Hunter & Wigham Richardson Ltd. The vessel is of 18,300 dwt, with an estimated service speed of 14 knots. The propelling machinery consists of a 6-cylinder Swan Hunter-Doxford oil, engine, arranged to burn boiler fuel and designed to develop 7,500 hhp at about 115 rpm. Auxiliary steam will be supplied by two Scotch boilers. The two-wing furnaces in each boiler are arranged for either oil firing or utilizing the heat in the exhaust gas from the main engine, while the center furnaces are oil-fired only. Two 245-kw generators driven by 6-cylinder 4-stroke oil engines, together with a 75-kw steam-driven generator, supply the electrical requirements of the ship.

The single-screw steam-turbine tank vessel "Overseas Explorer" for London & Overseas Tankers Ltd. was launched in July at the Haverton Hill shipyard of Furness Shipbuilding Co. Ltd., being the 165th tanker to be constructed by these builders. A deadweight of about 24,800 tons will be carried in a Lloyds summer draft of about 32 ft 4 in., the designed speed being 14¼ knots on measured mile trial.

Brazil To Add Seven Tankers

At the end of 1957 Brazil's tanker fleet consisted of 16 ships aggregating 230,000 dwt. Petrobras is adding seven more tankers of 33,000 tons and over, of which one is for delivery in 1958, three in 1959, and three in 1960.

Australia's Road Tanker

BP Australia's latest and largest road tanker is 45 ft long and weighs 30 tons fully laden. It makes a regular run carrying aviation gasoline from BP's Auburn (Sydney) installation to H.M.A.S. Albatross, the Royal Australian Navy's air station near Nowra, 100 miles south of Sydney. Maximum load capacity of the vehicle is 5,300 gal of aviation gasoline, 5,100 gal of motor spirit or 4,400 gas of benzol. Six compartments are provided, the highest capacity being that of No. 6 (970 gal) and the smallest that of No. 1 (660 gal).

First Deep Test Well In Malta

Drilling of the first deep test well in Malta by B. P. Exploration Co. was scheduled to begin on Sept. 1. The well, which is to be drilled near the village of Naxxar, about four miles northwest of Valetta, will be known as Naxxar No. 2. A shallow exploration well was drilled in the vicinity in 1955. A drilling rig capable of reaching a depth of 15,000 ft. has been brought from Sicily where B.P. is searching for oil. Early this year the Maltese government granted BP a new license to explore for oil in the Maltese Islands. Previously the company had carried out, under license, a geophysical survey of Malta.

40,000 B/D Refinery At Algiers

Beryl Algerie Compagnie Francaise des Petroles, Compagnie Francaise des Petroles B.P., Societe Shell d'Algerie and Standard Oil Co. (N.J.) have decided to form a company with the object of constructing an oil refinery near Algiers, as soon as possible. The refinery will be designed to treat Sahara crude oil and to yield all major products. The initial crude oil capacity of the refinery will be about two million tons a year (40,000 b/d). This will be sufficient to meet Algeria's oil product requirements, which it is estimated will amount to one million tons a year, at the time the refinery comes on stream. The refinery will also make products available for export.

New BP Test Well In Libya

Drilling of a second deep test well in Libya has been begun by D'Arcy Exploration Co. (Africa) Ltd., one of B.P.'s prospecting subsidiaries. Known as Wadi Zachem No. 1, the well is sited about 30 miles south of Hon, and 180 miles S.S.W. of Sirte. The company's first deep, test well, Castel Benito No. 1, 30 miles south of Tripoli, was abandoned last month at 3,500 ft.

Returns From Iraq Visit

G. H. Herridge, managing director of Iraq Petroleum and Associated Companies, has returned from a tour of operations in Iraq. In Baghdad he informed the government that he was impressed by the measures they had taken to ensure the continuance of operation and assured them of the continued cooperation of the companies. The Iraqi Ministers, in their turn, assured Mr. Herridge of their intention to honor existing agreements, reserving their right to invoke the terms of their letter of September 1951, which stated that in the event of a neighboring country receiving a higher average revenue per ton of oil exported than was currently received by Iraq, the Government would claim to receive no less. Welcoming the Ministers' assurance, Mr. Herridge pointed out that the circumstances envisaged by the 1951 letter had not arisen, but that if they should arise the company would be willing to consider and discuss the position.

Outstanding differences between the previous government and the companies regarding the calculation of the government's share of profits in respect of 1955 and 1956 were reviewed, and the government indicated their willingness to apply the mechanism for settling disputes provided in the agreement, which may involve arbitration. Mr. Herridge explained to the government the companies' plans for increasing productive and export facilities which, by the end of 1961, would permit a total export from Iraq at a rate of approximately 57 million tons a year. The government was also informed of the companies' agreement in principle to the relinquishment of portions of the areas covered by their concessions, and the companies undertook to frame proposals for further discussion.

New Range Of Steam Turbine

A new range of small high speed, geared steam turbines, rated 200 to 1,000 hp, has recently been announced by J. P. Hall & Sons, Ltd., Peterborough, for driving cargo pumps in oil tankers. Other duties for which it is adapted include pump and compressor drives, exhausting either to vacuum or against back pressure.

Fresh Water From The Sea

The Water Board of Guernsey has ordered the first sea-water evaporating and distilling plant for commercial operation in a country with adequate rainfall. Ample supplies of fresh water are essential for the fruit and flower industries should there be a local drought. The plant will produce half-a-million gallons daily from the sea more cheaply than the cost of reservoirs for collecting rain.

The Guernsey plant will be supplied by G. & J. Weir Ltd., Glasgow, who have already supplied plant producing three-quarters of the world's total output of fresh water from sea-water. A de-aerator unit will remove gases from the incoming sea-water, and chemical treatment will prevent formation of scale inside the plant.

Personals

To mark his 45 years' service with the Mobil Oil Co. Ltd., a dinner party was given in honor of V. C. Beaumont, host being F. P. Barribal, a director. Joining in 1913 as an office junior, Mr. Beaumont later saw service in the Army and RAF in World War I and, on his return, became the company's youngest salesman. In 1953 he was appointed district manager of the Midland automotive division, and three years later manager of the newly formed South Midland retail division. In recent years, he has filled an important role in the introduction and marketing of Mobilgas in the Midlands. Mr. Beaumont has been a member of the Institute of the Motor Industry since 1935, being the first honorary secretary of the Coventry Center at its formation in 1947, and subsequently chairman. He has also served on the committee of the West Midland region of the institute for a number of years.

Percy Joseph Hyde has been appointed engineer-commodore of BP Tanker Co.'s fleet, effective July 1. Mr. Hyde entered the service of BP Tanker Co. in 1931, and served in various vessels during World War II. He was chief engineer of MV "British Loyalty" when she was torpedoed and sunk in May 1942 at Diego Suarez. His injuries made him unable to resume duties until 1943. He is at present serving in MV "British Fame," and succeeds Charles Howard as engineer-commodore. END

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LATIN AMERICAN OIL NEWS

Brazil's Oil Use Up

Brazilian consumption of refined products reached 69,858,000 bbl in 1957; production totaled 43,227,690 bbls, or 61.88% of consumption.

Sr. Lucas Lopes, Brazil's new finance minister, in his report to the president on the economic situation, said more flexibility is needed in petroleum policy, particularly as regards commerce and exploitation so as to permit the participation of foreign capital.

Two additional tanks, of 22,500 cubic meters capacity, will be installed at the Santos docks this year, raising storage capacity to 2,600,000 bbl.

BRAZILIAN IMPORTS OF CRUDE AND REFINED PRODUCTS

January to March

	Metric Tons		Cost in U.S. $	
	1957	1958	1957	1958
Gasoline	183,087	236,894	8,499,000	9,734,000
Aviation gasoline	54,838	85,730	3,925,000	5,684,000
Diesel oil	259,277	275,275	10,542,000	9,419,000
Fuel oil	376,017	407,114	9,123,000	8,841,000
Lubricants	40,967	34,008	4,287,000	2,770,000
Kerosine	144,454	62,128	6,280,000	2,258,000
Crude petroleum	1,025,039	1,081,711	23,755,000	25,677,000
Totals	2,083,679	2,182,860	66,361,000	64,383,000

Creole Foundation Prize

A $10,000 biennial prize for the best work written about Venezuela in the fields of natural, physical, or social sciences will be offered by Creole Foundation. To be eligible, manuscripts may be submitted from anywhere in the world, and may be in Spanish, English, French, Portuguese, German, or Italian. Works presented in another language must be accompanied by a summary in one of the six eligible languages.

Brazil to Spend $900 Million

Col. January Nunes, president of Petrobras, has repeated that Petrobras goal by 1961 is 110,000 b/d of crude-oil production. Present output is 53,000 b/d. The expansion is based on Bahia reserves, which are now put at 418 million barrels. Earlier estimates put them at 700 million barrels.

Mr. Nunes said Petrobras hopes to process all refined products, and to this end two new refineries are being built in Rio de Janeiro and in Minas Gerais, while four others are being expanded. The 1961 refinery capacity is planned to be 330,000 b/d, compared to present capacity of 130,000. Petrobras plans to spend $900 million for expansion of prospecting, drilling, refining, pipelines, tankers, petrochemicals, including synthetic rubber and shale development, through 1961. He said Petrobras would welcome "short, medium, and long-term loans . . . for the acquisition of equipment, materials, raw materials, and services which are needed."

Bahamas Drilling

Consolidated Cuban Petroleum Corp. has been given oil exploration rights on 1,150 square miles of land and 350 square miles of adjacent submarine areas in the southern part of Andros Island in the Bahamas. A preliminary survey within three months is planned.

Siebens Leaseholds Ltd., meanwhile, has obtained oil exploration rights on some 820 square miles of land and submarine areas on Andros.

Mexican Imports

Crude imports into Mexico in 1957 totaled 1,433,814 bbl, of which 940,579 bbl came from USA and 493,814 from Venezuela, Pemex reports. These figures are higher than official import statistics put out by the Ministry of National Economy, but Pemex said the official government figures failed to include 19,975 bbl of crude and 73,204 bbl imported by private companies.

Venezuelan Drilling

Venezuelan drilling in second quarter this year continued at about the first quarter pace, with 262 wells drilled in the April-June period. It brought total drilling in the first half of year to 527 wells. In the second quarter, total included 212 successful development wells, 15 producing wildcats, 19 dry holes from development drilling, and 16 dry holes in wildcat operations. The same figures for the first six months included 425 development wells, 35 wildcats (one gas, the rest oil), 26 dry holes from development drilling, and 41 dry holes for wildcats.

Union Oil in Costa Rica

Union Oil Co. expects to spend an additional $3.5 million in Costa Rica on exploration work including drilling. This will have brought the total cost to $12.5 million, with no commercial discoveries yet.

Signal's New Maracaibo Well

A new wildcat pool discovery by Signal Oil and Gas of Venezuela, operator of a 43-square-mile concession in Lake Maracaibo for foreign subsidiaries of Hancock Oil Co., Pure Oil Co., Standard Oil Co. (Ohio), and Signal Oil & Gas Co., is Centro 5X. It flowed 2,280 b/d of 38.1-gravity clean oil from Eocene sands. It is located three miles north of the nearest production found in Centro 3X and five miles north of Centro 6X, completed in July. Centro 5X, along with the other producing wells in the concession, is presently shut in while production facilities are being completed.

Colombian Exports at Maximum

Crude exports from Colombia have averaged 62,000 b/d in first four months of this year. Industry sources estimated maximum production at MER from present fields at 135,000 b/d, while current production is 125,000 b/d. Shell-Condor, SA and Colombian Petroleum Co. (Texas-Socony), have some production shut in, but other producers are believed operating at maximum.

Brazilian Refinery Runs

The following table, published by Petrobras, shows the estimated production of the Landulfo Alves (Mataripe) refinery, when amplified, and that of the Duque de Caxias refinery.

Products	Daily Production in Barrels	
	Landulfo Alves	Duque de Caxias
Liquefied gas	1,926	3,000
Gasoline, type A	13,133	25,100
" type B	—	2,500
Kerosine	4,996	14,400
Diesel oil	4,254	16,400
Fuel oil	8,043	26,300
Lubricants	2,081	—
Paraffin	423	—
Crude capacity	37,000	90,000

The Landulfo refinery, which has been processing 6,000 b/d, has been authorized by the Petroleum Council to adopt provisionally a process raising the charge to approximately 10,000.

The Presidente Bernardes refinery (Cubatao) raised processing capacity from 73,000 b/d to 90,000 b/d in August.

Brazilians for Bolivia

Businessmen of Sao Paulo reportedly will organize a company to develop a Brazilian petroleum concession in Bolivia following an appeal by Col. Jose Alexinio Bittencourt, president of Brazilian National Petroleum Council.

Immediate construction of a pipeline from the producing fields to Santos is not considered feasible because of estimated $150 million cost. It is anticipated movement of the petroleum from the concession would be by rail and river transportation.

Brazil Activity High

Crude production (estimated) during July was 1,705,000 bbl (55,000 b/d), August, 1,736,000 (56,000 b/d). Rigs operating in August, 52.

Wells recently spudded include: *wildcat AD-1-AZ*, in Amazonas, on the banks of the Andira river, about 49 miles southwest of Parintins; *PL-st-1-PA* (stratigraphic), in Para, Portel, at 135 miles west of Belem; *wildcat JA-3-AL*, in Alagoas, near Jequia, where the existence of oil has been proved; *wildcat SMC-1-AL*, in Alagoas, 2.4 miles from Sao Miguel dos Campos; *0-st-1-SP* (stratigraphic), in Sao Paulo, 3 miles north of Olimpia.

Soviet Offer to Brazil

Petrobras issued the following note in August:

On May 13 Petrobras received a telegram from the Soviet government proposing to sell Brazil between 150,000 and 200,000 tons of crude petroleum in exchange for cocoa beans to an equivalent value. On June 26 the Economic Department of the Brazilian Foreign Office, to whom the proposal was submitted by Petrobras, replied that no political or diplomatic objection to the proposal existed. The proposer, Sojuzneftexport, was thereupon asked for further particulars of the offer. As the reply, received on July 26, lacked certain essential data, these were asked for, but are not yet at hand.

Proposals to Exploit Bolivian Oil

The date for receiving proposals from private Brazilian firms to prospect and exploit Bolivian oil has been extended to September 12. Two groups have submitted offers: one is connected with Refinaria e Exploracao de Petroleo Uniao, the other with Oscar Ferreira Filho, both of Sao Paulo. The proposals are being examined by the Brazilian Bank for Economic Development, and other interested groups are expected to submit proposals.

Largest Venezuela Well Signal's

Highest production rate to date in their Venezuelan concession in Lake Maracaibo has been announced by Signal Oil and Gas of Venezuela, operator of a 43-square-mile concession for foreign subsidiaries of Hancock Oil, Pure, Standard of Ohio, and Signal.

The development well, Centro 7, flowed 6,600 b/d of 27.3-gravity clean oil from 137 ft of perforations open to production in the upper Eocene sands. This largest well to date is located immediately west of Centro 4X, and was drilled to a total depth of 10,320 ft and completed in 34 days' time, which also represents a new record for the operation.

Crude Line in Venezuela

Williams Brothers is constructing approximately 113 kilometers of pipeline in Venezuela for Compania Shell de Venezuela Ltd. The line extends from Bachaquero to Puerto Miranda, in the state of Zulia, along the eastern shore of Lake Maracaibo. The line is a buried crude-oil pipeline and is to be a part of Shell's North Terminal on Lake Maracaibo. Between Bachaquero and Cabimas the pipe size is 34-in. OD by ⅜-in. WT.

WILFRED B. TAPPER has been elected vice president of Chaco Petroleum SA, in Cochabamba, Bolivia. Chaco is the Bolivian subsidiary of TULM Corp., owned by Tennessee Gas Corp., Lion Oil Co., Murphy Corp., and Union Oil and Gas Corp. It took over the McCarthy concessions in Bolivia during 1947, and is now conducting active exploration with a staff of about 300, including drilling of a deep exploratory well at Agua Salada.

Take a whip to a sluggish horse

Wilhelm Ostwald, noted German scientist and one of the pioneers of modern physical chemistry, ingeniously compared the action of a catalytic agent to that of a whip on a sluggish horse —a simple analogy which illustrates that a catalyst can be used to accelerate the rate of a chemical reaction. To carry the analogy further, the 'accelerator' must be selected with care and applied correctly—and this is particularly important with modern industrial catalysts.

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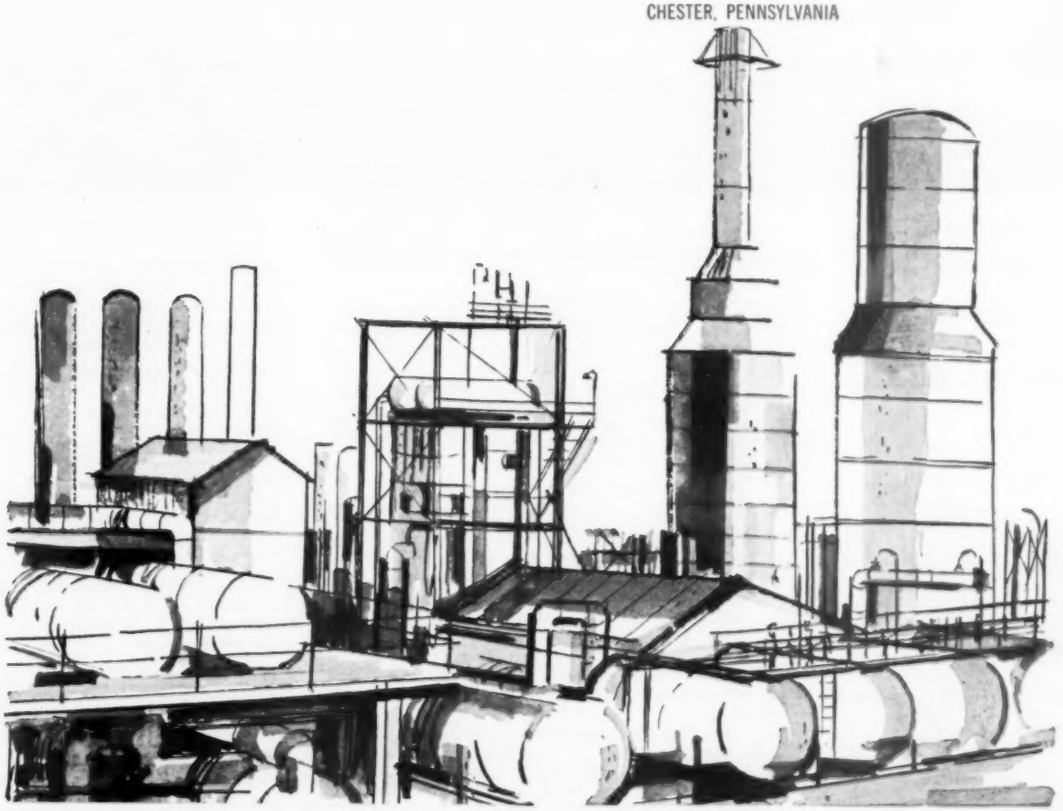

CANADIAN NOTES

Turbojet For Canada

First use of Dresser turbojet drilling in Canada was in three Shell Oil Co. gas wells at Waterton Park-Castle River, for part of footage. Imperial Oil Ltd. is reported planning to run experimental footage with turbojet equipment in some wildcat wells in the fall.

PEI Well Dry

Imperial Oil Ltd. has announced abandonment of its second exploratory well on Prince Edward Island. It was abandoned at 4,622 ft. The company plans a third test in the MacDougall area, between Porthill and Wellington.

Interprovincial Deliveries Up 6%

Crude delivered through Interprovincial pipeline system for the first six months of 1958 increased 6%, to 53.1 million barrels. "In terms of barrel-miles, throughputs increased 12%, principally due to the extension of the system to the Toronto area. Company's $12.3 million construction program included 82 miles of 24-in. loop between Edmonton and Regina which now provides a double line from Edmonton to Superior.

Consolidated net income for the first six months of 1958, amounted to $5,605,853, $1.11 per share on the outstanding stock. For the comparable 1957 period net was $4,919,501, 97 cents per share.

Trans-Mountain's report showed daily average oil deliveries of 90,289 bbl for first six months of 1958, compared with 183,316 for same 1957 period. Slump in deliveries was attributed to loss of exports to the USA.

Estimated consolidated net profit was $348,000, compared with $629,000 in 1957. Gross revenue in the six-month period was $7,302,000, compared with $16,373,000.

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Imperial Forms Pipeline Co.

A bill to empower Stanmount Pipe Line Co., a wholly owned subsidiary of Imperial Oil Ltd., to build pipelines anywhere in Canada has received approval of the Commons Railways Committee.

The company now has power to build oil and gas lines in and between Saskatchewan, Manitoba, Ontario, and points outside Canada. It operates no pipelines at present. Authority to construct lines anywhere in Canada has been sought by the company in readiness for possible future oil and gas discoveries in various parts of Canada, including Prince Edward Island, New Brunswick, and Quebec.

Swan Hills Line Let

Contracts for construction of a $6,500,000 oil pipeline from the Swan Hills oil field to Edmonton have been let to two Alberta contractors. Major backers of the line are Home Oil Co. Ltd. and McColl-Frontenac Oil Co. Ltd. The northern 40 miles from Swan Hills to Fort Assiniboine will be built by Mannix Co. Ltd., of Calgary. The southern spread from Fort Assiniboine to Edmonton was awarded to Fulton-Bannister, of Edmonton.

New Canadian Rig Firm

Arnim Drilling Co. Ltd. has been formed in Calgary as sponsors of a newly imported drilling rig designed specifically for slim-hole drilling. Rig is a J-450 built in Houston, Texas, last year by Cardwell Manufacturing Co. and used until recently in a 16-well drilling program in Trinidad by Standard of California. The rig is expected to be used primarily in the Northwest Territories and in Alaska. The 8,000-ft to 10,000-ft rig can be moved in 10 loads as compared with about 35 for conventional rigs of comparable depth.

President of the new firm is J. K. MacMillan, designer of the rig, formerly president of Northwest Seismic Co. R. C. Arnim, vice president and director in charge of operations, formerly was asistant drilling superintendent for John W. Mecom. He also served in an engineering capacity with Mobil Producing Co.

Pipeline Service Company

Organized to service the pipeline and plant industry in western Canada, Belen-Lynn McGuffy Co. Ltd. has established headquarters in Calgary. R. James Belding and John W. Ensch have been elected the company's president and vice president, respectively. Mr. Belding served formerly as purchasing agent for Dutton-Williams Bros. Ltd., and Mr. Ensch as assistant purchasing agent.

Canadian Merger

Plan has been approved in principle for merger of two Canadian independents—North Star Oil Co. Ltd. Winnipeg, and Cree Oil of Canada Ltd., Calgary. North Star operates a 12,000 b/d refinery at Winnipeg and a 2,500 b/d plant at Grande Prairie, and has retail outlets. Cree is engaged in exploration and development in western Canada.

B-A's New Refineries

British American Oil will open two major plants costing a total of $50 million in mid-October. A few miles south of Pincher Creek in southern Alberta, B-A will have a natural-gas processing plant. Just outside Vancouver, B.C., the company's Port Moody refinery was opened, October 17.

The Pincher Creek plant will make B-A the largest single supplier of natural gas to the Trans-Canada Pipe Line. Initial capacity will be 25,000 gal of propane, 40,000 gal of butane, and 450 long tons of sulfur.

The Port Moody plant on Burrard Inlet will bring to six the number of B-A refineries operating in Canada. The plant's capacity is 20,000 b/d, and will include B-A's and B.C.'s first alkylation unit for production of high-octane gasolines.

BP Canadian Marketing

BP Canada Ltd. expects to have over 400 service stations in operation in eastern Canada by the end of 1958. In the past 18 months, since the BP group announced its entry into the Canadian market, BP Canada has built or purchased 300 service stations in Quebec and Ontario.

This expansion of marketing outlets is part of a program including construction of a new 25,000 b/d refinery at Ville d'Anjour near Montreal. Work on the refinery, which is scheduled to come onstream in mid-1960, is now under way.

Canada Production Forecast

Revised estimates of 1958 crude production are for average of 450,000 b/d, down 10% from 1957 peak of 500,000 b/d. Forecast for 1959 is 510,000 b/d, up 11% from current year. Unpredictable factor of export market on west coast could put this figure higher, as it is almost physically impossible for it to go any lower.

Cantal Strike

Imperial Oil reported 76 ft of net pay in Mission Canyon member of Mississippian at Imperial Cantal No. 2-34, extension discovery southeast of Queensdale oil field in southeastern Saskatchewan, and recovered up to 3,000 ft of light oil on drill-stem test. Pay zone is one of thickest in whole region.

Pacific Pet Bids On Humber

Pacific Petroleums Ltd., Calgary, has offered to acquire shares of Humber Oils Ltd., Calgary on the basis of one share of Pacific for nine shares of Humber. Humber recently announced acquisition of a 50% interest in 53,000 square miles covering a large portion of the Great Barrier Reef in Australia.

Triad Farmout

Triad Oil has given large farmout of half interest in 1,300,000 acres of exploration permits in northeastern British Columbia to affiliate BP Exploration, which is committed to $5 million expenditure on exploration and drilling over three years. Triad retains 50% interest, with no further obligation.

Canadian Sulfur Markets

Large quantities of sulfur from sour-gas reserves in British Columbia and Alberta are heading for world markets under plans announced by Jefferson Lake Petrochemicals of Canada Ltd. First shipment of B.C. sulfur produced from hydrogen-sulfide gas was made, August 4, from the company's $2,250,000 plant at Taylor.

Personals

A.G.T. WEAVER, petrophysicist, and logging engineer for Shell Oil Co. of Canada, has been transferred from Calgary to The Hague, Netherlands, on special assignment. He is a past president of Canadian Well Logging Socy.

HAROLD T. HORNFORD has been appointed chief geologist of Richfield Oil Corp.'s Canadian Division, with headquarters at Calgary. He succeeds Walter Record, who is returning to the company's Los Angeles office.

JOHN S. POYEN has been appointed assistant manager of Edmonton division, Imperial Oil Ltd. JOHN H. HAMLIN succeeds Mr. Poyen as manager of the western region contracts and unitization department in Calgary.

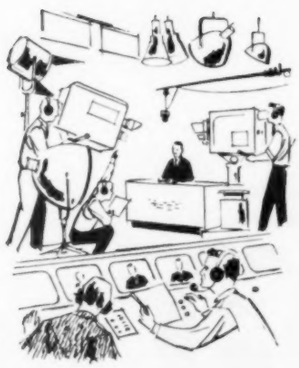
S. B. LAING has resigned as secretary-treasurer of Bailey Selburn Oil & Gas Ltd., Calgary. He is succeeded by C. M. MacInnes as secretary and H. W. Bliss as treasurer.

JOHN R. McNULTY has been named vice president, industrial relations, a new position with Canadian Husky Oil Co. Ltd., at Calgary. He joined the company in 1949, and previously was with Ohio Oil Co.

VERNON TAYLOR, manager of producing operations in western Canadian for Imperial Oil Co. Ltd., has been made a director of the company at Toronto. W. D. C. MACKENZIE will succeed Mr. Taylor in Calgary. He has resigned as a director.

C. U. DANIELS has retired as board chairman for Royalite Oil Co. Ltd. He joined the company in 1950 as president and managing director, and in 1955 was appointed chairman. He will take up permanent residence in Fort Worth, Texas.

there's more to Cities Service than meets the eye!



Behind the performers on even the simplest television show is at least one writer, producer, director, camera crew, prop man and engineer—to say nothing of the fantastic network of electronic equipment that transmits their efforts to you.

Even the largest TV screen is comparatively small in area—but it is a window on the world.

The newscaster who brings a summary of the day's events appears alone on this screen, but behind him—unseen by the TV audience—are thousands of men and women who made his program possible. They include the people who designed and built the facilities of TV transmission, cameramen, technicians, script writers, directors, producers, newsmen throughout the world, and many others.

Producing gasolene is like that. To provide the motor fuel which flows from pump to car requires a host of people who must find and produce the crude oil, refine it, test it in laboratories, transport it to distributing points, and finally deliver it to the station tanks to await the customer's order to "fill 'er up."

In the case of Cities Service, one of the nation's leading oil companies, all this required a capital investment of more than $179,000,000 in 1957 alone. It is money well invested, for petroleum products are vital to modern living—second only in importance to food itself.

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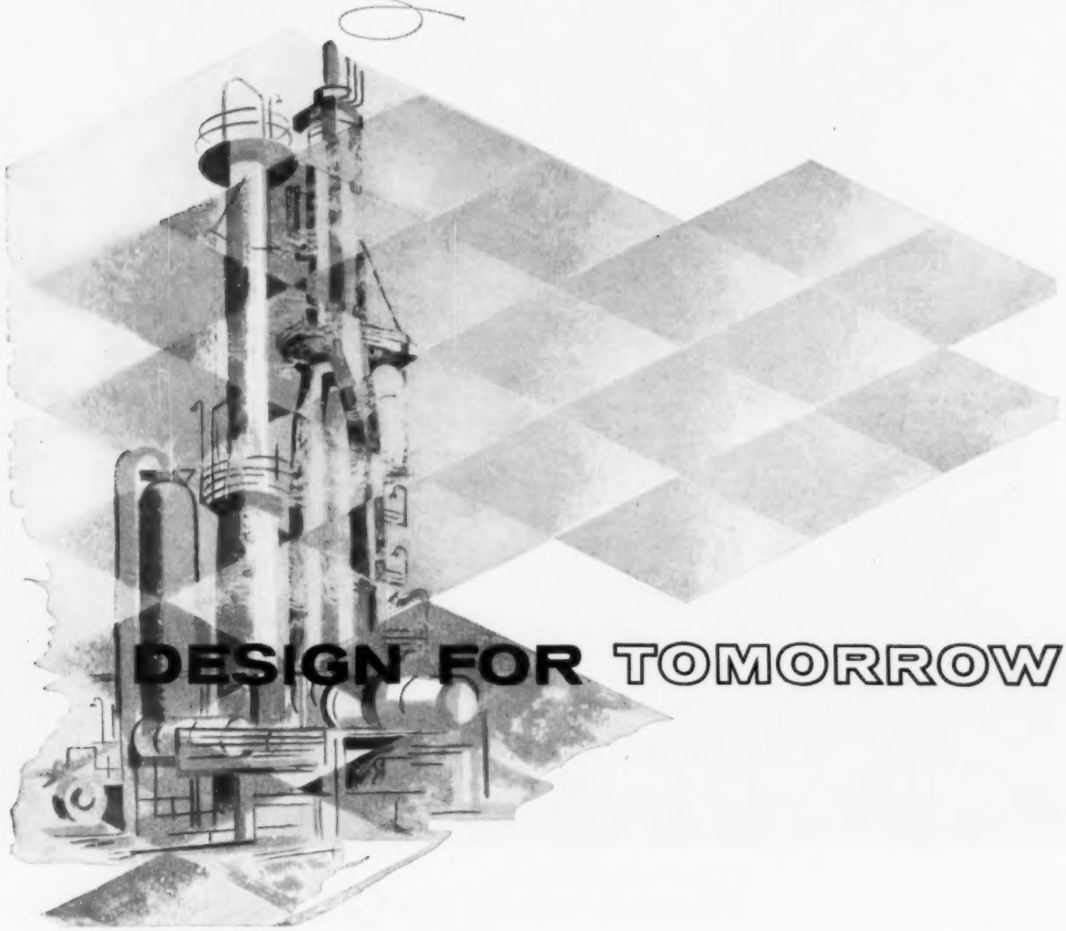

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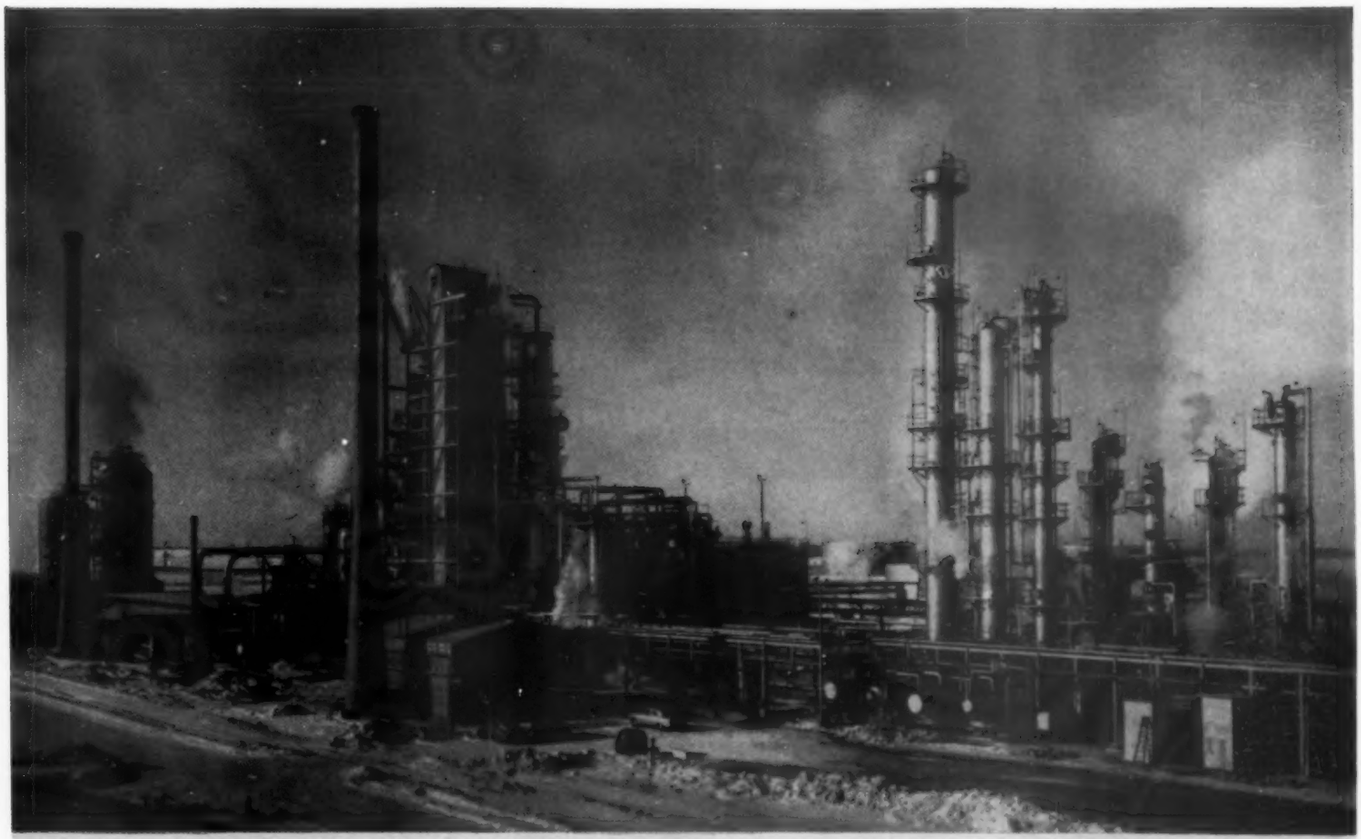

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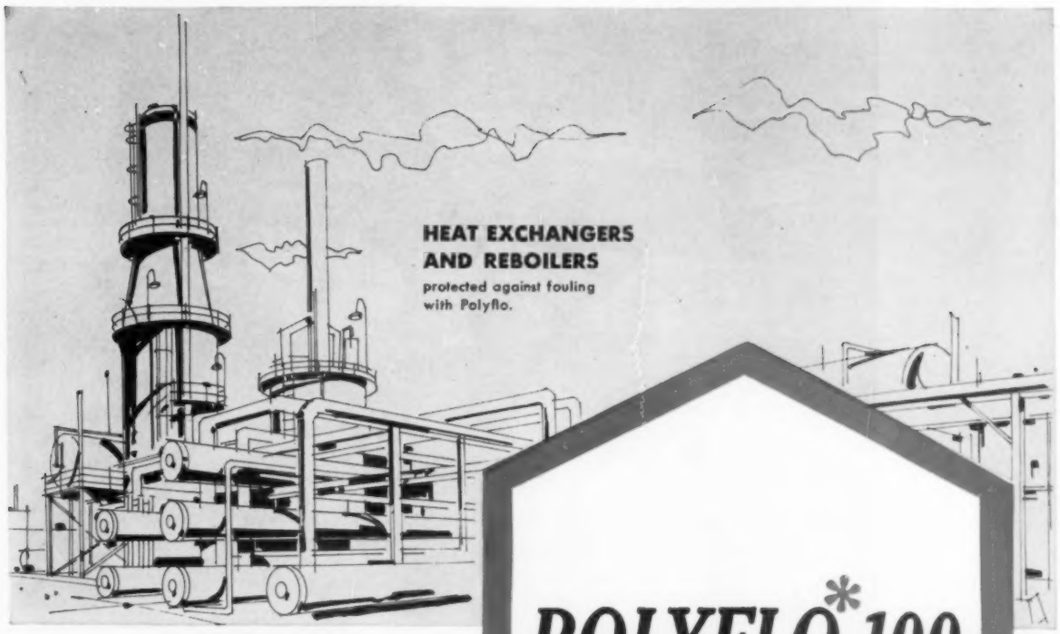

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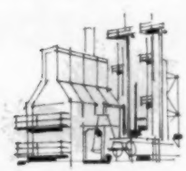
Polyflo is but one of a variety of inhibitors and additives developed by UOP for petroleum refiners. Write our Products Department for detailed information on these products. Ask also about the services of our staff of treating field engineers, who will gladly work with you to solve specific problems.



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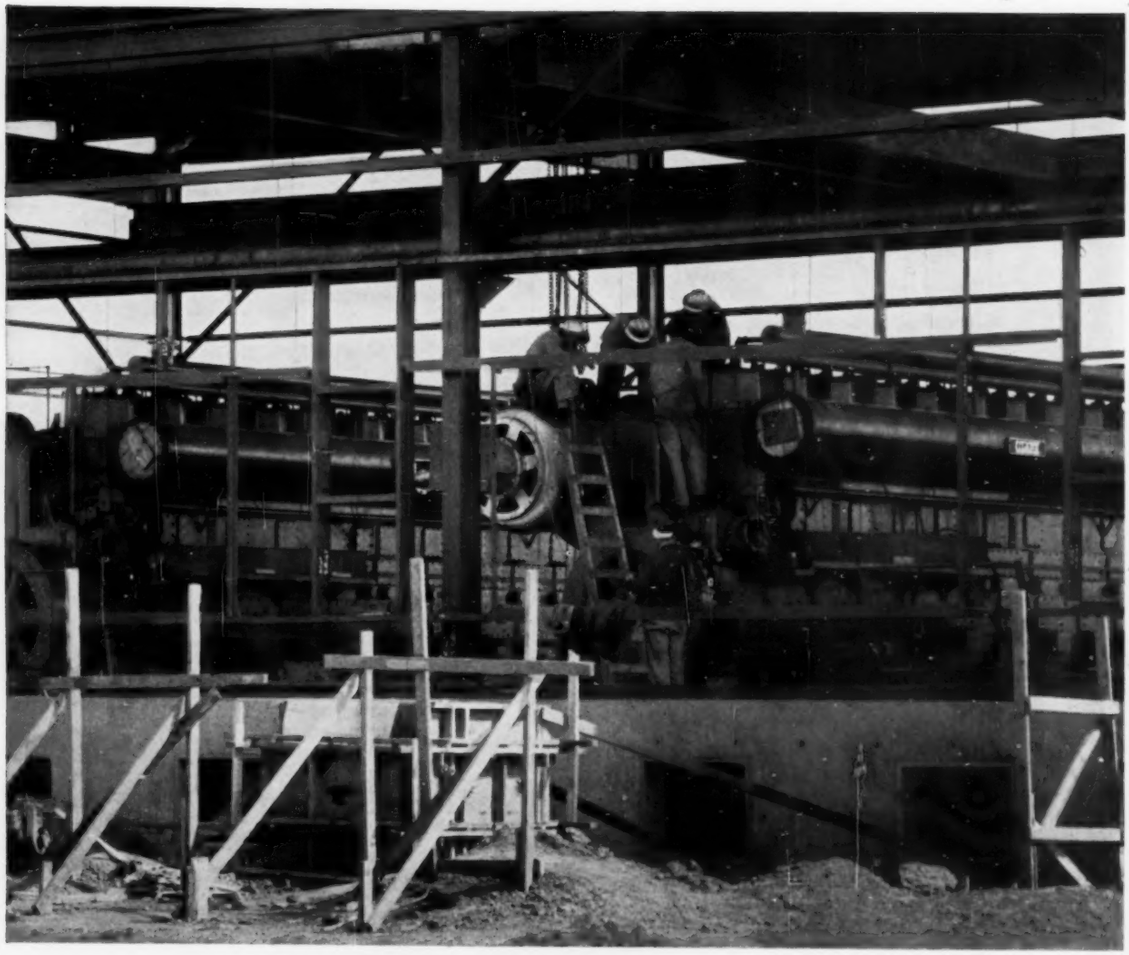
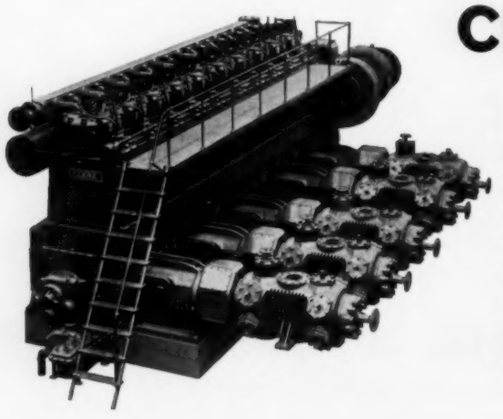


NINE CLARK TLA-10's

Clark turbocharged



Nine Clark 3400 bhp. turbocharged, 2-cycle TLA-10's will soon be handling all of Trans-Canada's compressor requirements for the big 34" western section of one of the world's largest gas pipelines. Here in the prairie provinces, loads will be the heaviest . . . dependability and economy of operation a must. But that's no problem with modern TLA-10's on the job. They are specifically designed for 3400 bhp. loads with no encroachment upon overload carrying ability. If extra power is needed to meet emergencies, it is there for the taking.

Furthermore, as the result of an important break-through in compressor technology, these TLA-10's will pump more gas

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units furnish 30,600 horsepower

at less cost per thousand cubic ft. of gas compressed than any compressor ever built! And because compressor cylinder headers have been electronically calculated on the Clark Analog Computer none of the compressor horsepower will be lost in fighting standing waves or wave fronts in the piping.

There are seven models of Clark TRA and TLA compressors available in the 1100-3400 bhp. range. Our application engineers will be pleased to prove to you why modern Clark turbocharged compressors will outperform all others. Call him or write for Bulletin 151, Clark Bros. Co., 1521 Lincoln Avenue, Olean, New York.

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Kellogg Alkylation Unit Minimizes Gulf Revamp Costs

Economy-minded engineering by The M. W. Kellogg Company enabled Gulf Oil Corporation to minimize downtime and capital investment when increasing the capacity of Alkylation Unit No. 1 at its Port Arthur refinery.

Now producing 5,000 BPD of alkylate, this former 1,500 BPD unit was expanded primarily by installing two modern, five-section Kellogg Model B Cascade Reactors—shown at left. Other equipment added included pumps, exchangers, vessels, and instruments. By utilizing four original towers and much of the original equipment, costs were reduced considerably.

Despite the problem of integrating the existing equipment with the new, downtime between shutdown of the old unit and putting the expanded facilities on stream was only one month—an insignificant loss compared with savings in investment.

In this case, Gulf's own maintenance crew hooked up the new unit to the existing towers. Kellogg operators assisted in bringing the job on stream.

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Increasing use of alkylate for blending into motor fuels makes these two up-to-the-minute processes highly important to petroleum refiners. Butamer is a new process for producing isobutane . . . "HF" Alkylation is an efficient, economical process which combines isobutane with olefins to produce alkylate, much in demand today as a motor fuel component.

With the advent of high compression ratio engines, usually starting at 9.5:1, motor fuel, especially those deficient in isoparaffins, have been associated with an unusual engine noise called "rumble." Further study reveals this rumble can be eliminated through the use of a better balanced fuel, namely using a fuel composed of a greater volume percentage of isoparaffins. Alkylation produces a high octane isoparaffin that also has good sensitivity, ignition point and combustion characteristics.

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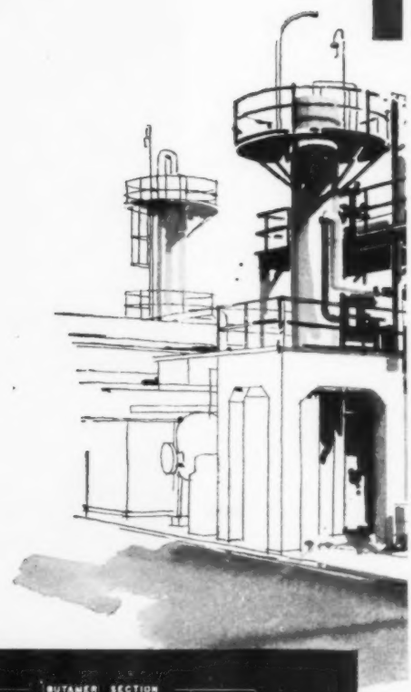

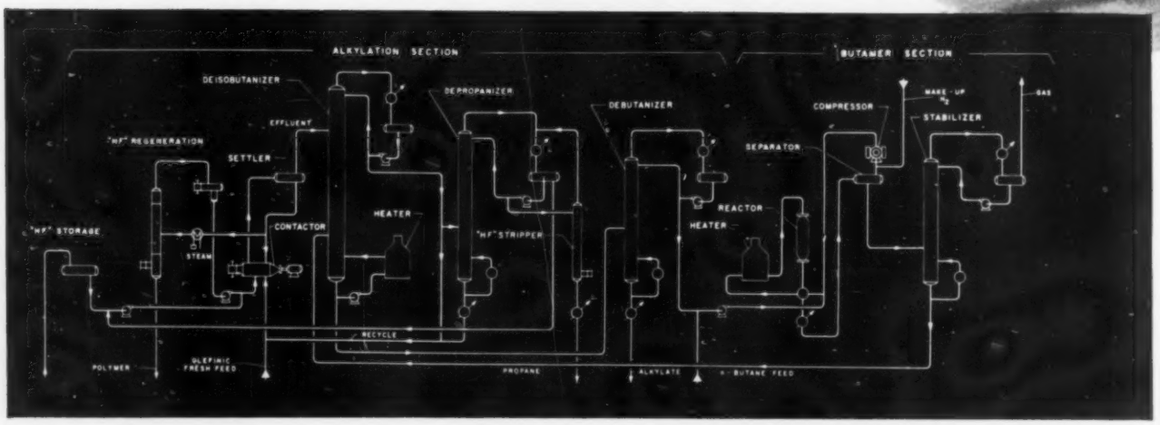

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HF Alkylation

Butamer—Heart of this process is a noncorrosive, stable and rugged platinum-containing catalyst especially developed by UOP. Capable of operating at relatively low temperatures, its use assures a sufficiently high concentration of isobutane in the reactor effluent to eliminate excessive recycle of normal butane.

Operating under hydrogen pressure, with low hydrogen-to-charge ratio, the high catalyst activity results in economical liquid hourly space velocities, thus requiring only a modest catalyst inventory. The mild operating conditions further assure minimum loss to by-products.

HF Alkylation—"HF" Alkylation is a catalytic process which combines olefins such as propylene, butylenes, and amylenes with isoparaffins (usually isobutane) to form a mixture of branched chain hydrocarbons of higher molecular weight known as alkylate for aviation and motor fuel.

These two processes are readily and economically integrated. Together, they form the ideal, most practical method for producing alkylate.

Write for detailed information. Ask also about other UOP refining and petrochemical processes, available to refiners everywhere, for improving operating efficiency and producing better and more profitable petroleum products.

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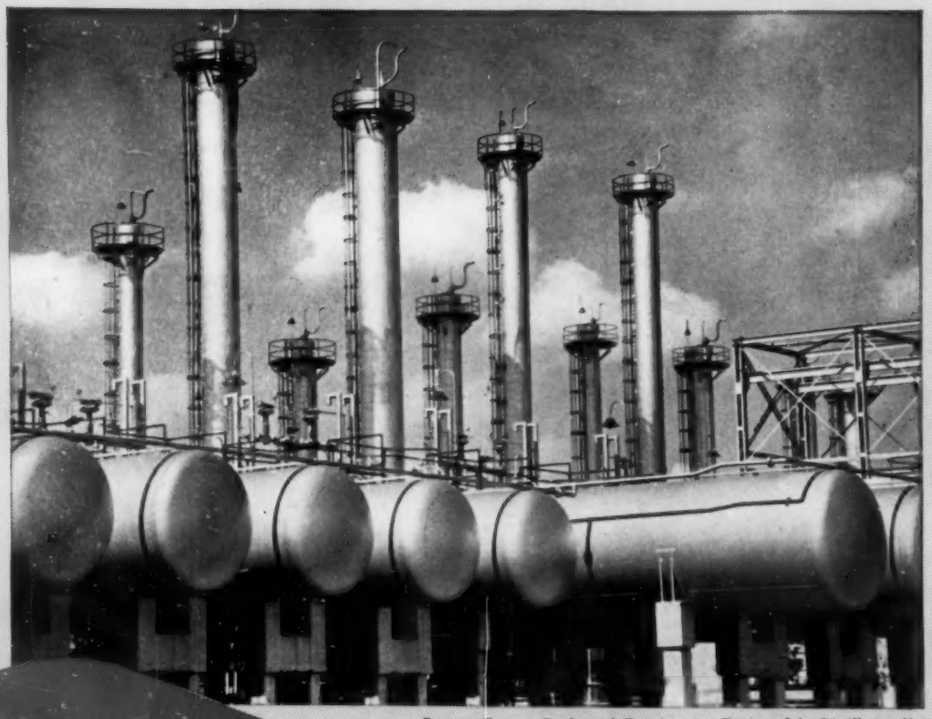

Pressure Storage Tanks with Fractionating Towers of the Distillation Unit at the new Shell Chemical Plant, Stanlow near Chester, Eng. (A Shell Photograph)

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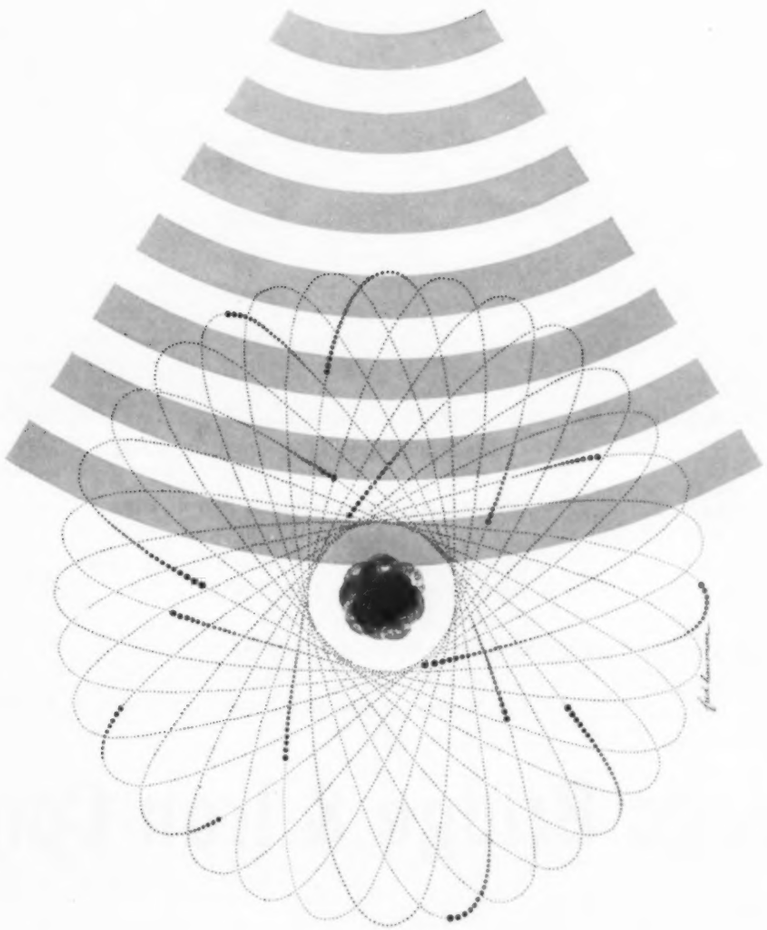

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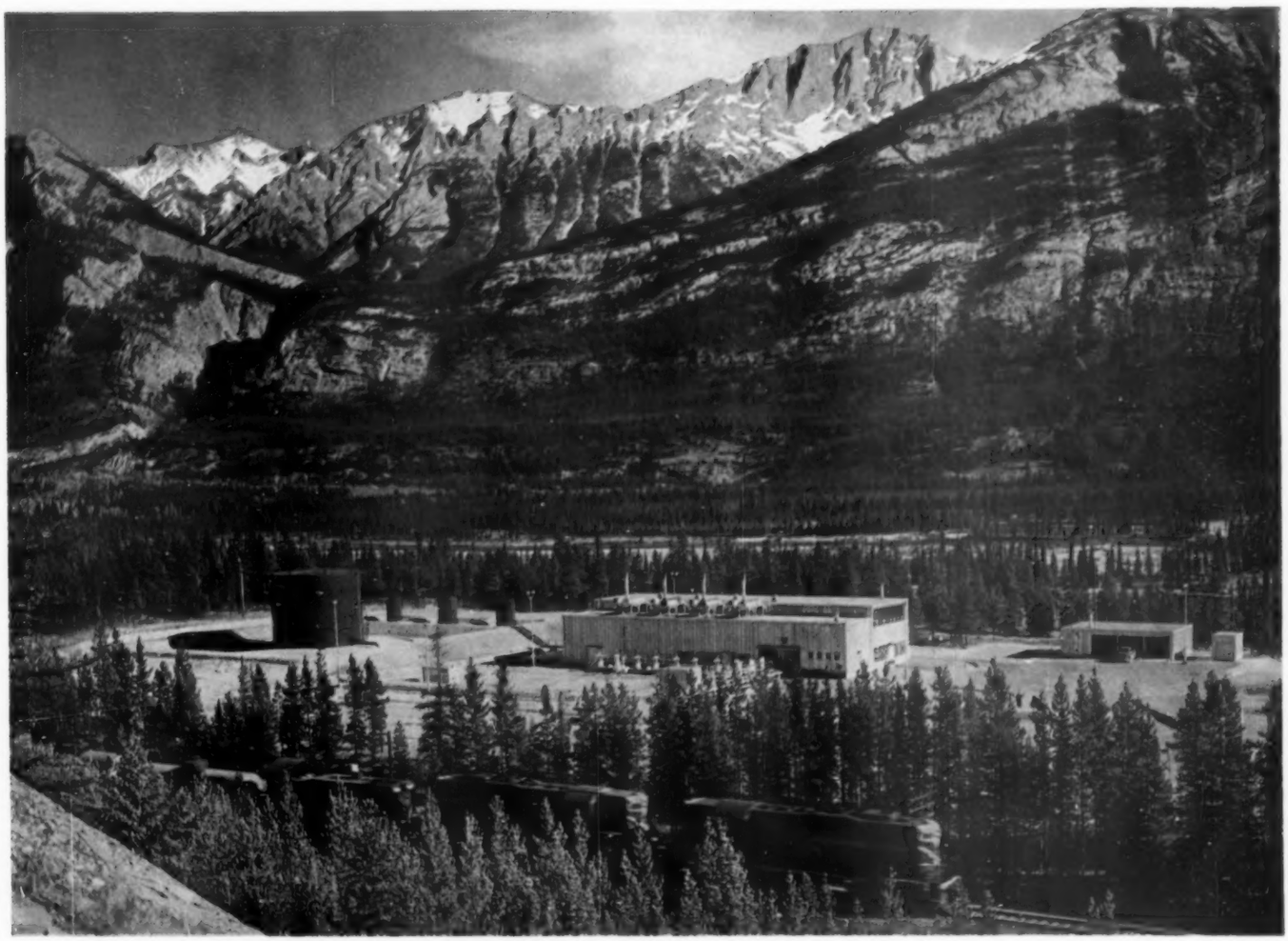


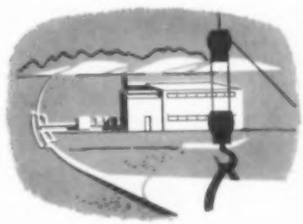
The towering peaks of Jasper National Park form a spectacular backdrop for Jasper—one of six new Trans Mountain pump stations.

Main Line Over The Canadian Rockies

Last year, Trans Mountain Oil Pipe Line Company completed a major expansion which increased capacity 25 per cent—from 200,000 to 250,000 barrels per day.

Boosting oil over the Canadian Rockies—once the exclusive job of railroad tank cars and giant locomotives—now is a task for Trans Mountain's 24-inch pipeline system and the powerful Jasper Pump Station.

The 700-mile system began operation in the fall of 1953. Transporting Alberta oil to refineries near Vancouver and on the United States Pacific Coast, the pipeline crosses two towering mountain ranges through difficult and ruggedly-beautiful country.



The original project and subsequent expansions were completed under Canadian Bechtel management of engineering and construction.

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What Trans-Canada means to Canada

by N. E. Tanner
Chairman of the Board
Trans-Canada Pipelines Ltd.

The final weld on Trans-Canada's more than 2,200-mile-long pipeline, the largest single pipeline project ever undertaken, heralds the start of transmission of natural gas to Canadian homes and industries as far east as Montreal. The line, following an all-Canadian route, provides further manifestation by Canadians as a whole of their desire to overcome topographical barriers in an effort to produce a greater degree of economic and political unity within the country. Trans-Canada Pipe Lines Ltd., in constructing this project, faced similar opposition and overcame many of the same difficulties as the Canadian Pacific Railway—the nation's first coast-to-coast communications link. The probable impact of Trans-Canada's pipeline on Canadian economy is expected to parallel that of the nation's first transcontinental railway.

The increase in industrial development in eastern Canada during the past few years has put a burden on the source of energy available to the area. Coupled with this eastern market is the existence of abundant reserves of natural gas in Alberta. By satisfying this market requirement, Canada has placed another link in the economic chain which tends to bind together various segments of a nation widely separated both by distance and topography. The supply is sufficient to meet the forseeable Canadian demand with a surplus for export.

The Trans-Canada natural-gas line runs through the heart of a territory in which is concentrated the bulk of Canada's 16 million people. The total population for communities which will be served by gas supplied by Trans-Canada has increased at the rate of 21.2% over a five-year period—a rate of growth which is greater than the 19.7% rate of growth for the total Canadian population over the same period. This growth, especially when compared with the 8.9% rate of growth for the population of the United States for the same period, gives ample indication that Trans-Canada will be serving dynamic and rapidly growing part of the Canadian economy.

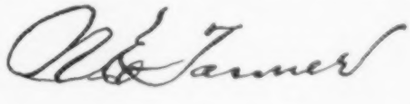
The major residential uses of natural gas will be for cooking and house and water heating. However, more extensive use of gas for refrigeration, clothes drying, garbage disposal, and airconditioning is anticipated as contractors prepare homes for an estimated three million people in the next 20 years in Ontario alone. This will open up extensive markets for gas appliances in Canada.

Industrially, natural gas and the pipeline project have already given an added stimulus to the metallurgical industry and the pulp and paper industry, particularly in northern Ontario. The Trans-Canada line runs directly through the Pre-Cambrian shield of northern Ontario. Establishments of new industries and expansion plans for existing ones along the route have amounted to an investment of over 100 million dollars since the start of the project. The line also runs past 13 pulp and paper mills between Kenora and North Bay, making natural gas available to them for heating and other energy requirements. The availability of natural gas and its byproducts has sparked a $100 million expansion program in the Canadian petrochemical industry. In the field of elemental sulfur, the Pincher Creek gas field in southern Alberta will supply a large amount of Trans-Canada's gas requirements. And the stripping and cleaning process of the gas from this field will yield some 700 tons of sulfur daily, making it a great source of sulfur from natural gas.

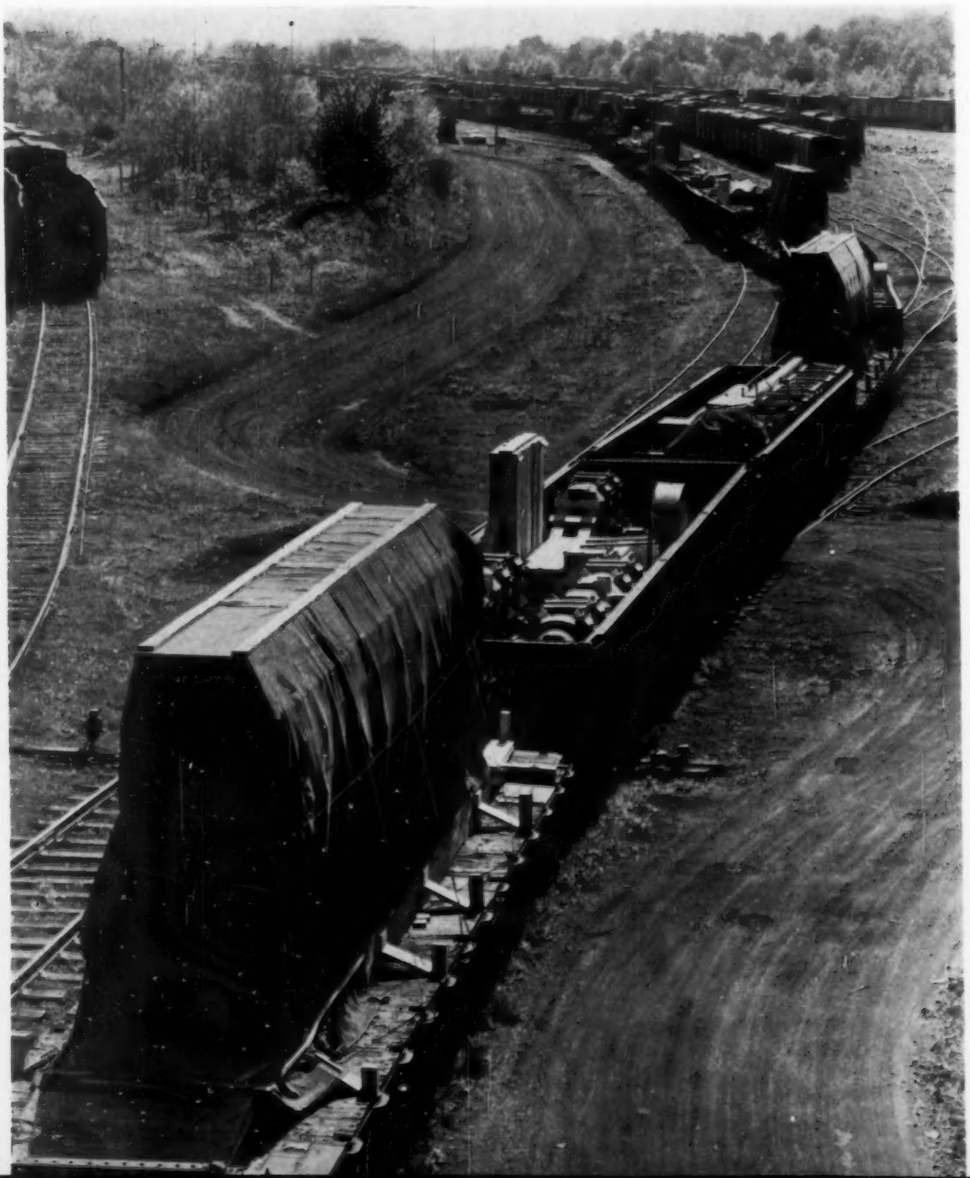
The introduction of natural gas, particularly in the East, is expected to have a significant effect in Canada's field of foreign trade. In accounting for all factors concerned—particularly with regard to the importation of coal, gas, and elemental sulfur—some people have felt optimistic enough to estimate that the function of Trans-Canada's gas pipeline on the Canadian economy will realize over $200 million in savings and earnings per year.

There is another saving, not in terms of dollars, which will result from the pipline. This is in terms of people. Hundreds of Canadian engineers and highly trained scientists have moved to other countries. Canada did not have enough jobs for these people. The gas industry is creating tens of thousands of new jobs, through which are distributed hundreds of millions of dollars in wages each year, which should help alleviate this situation.

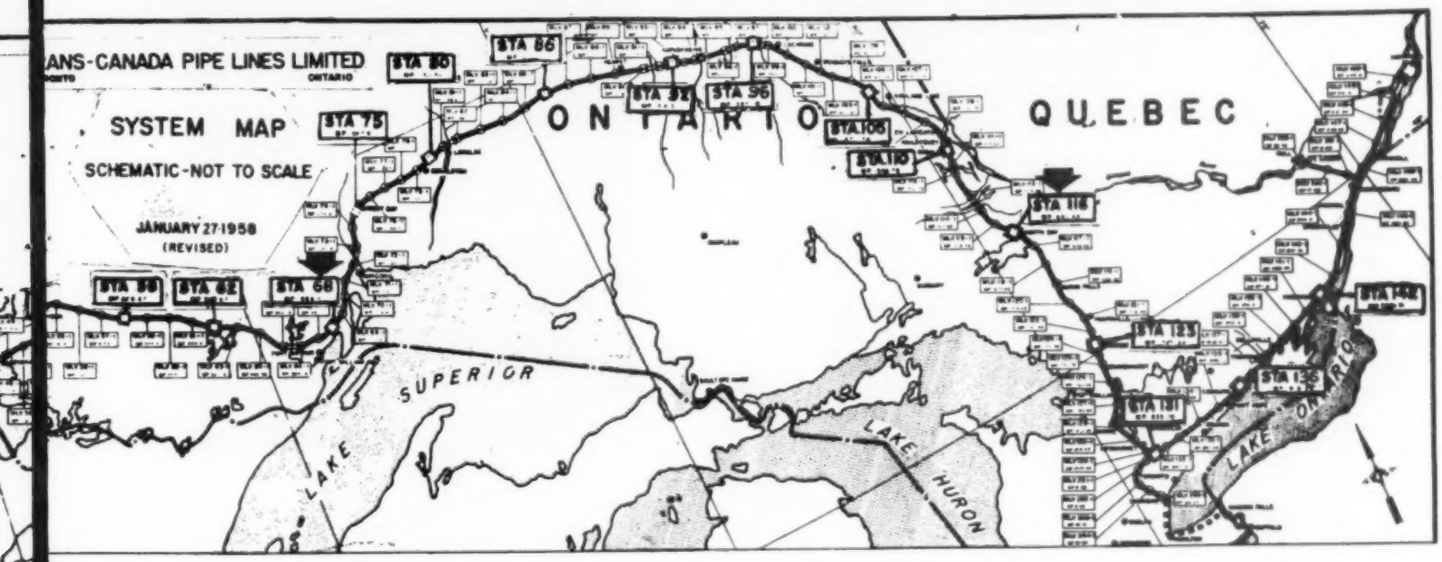
The Trans-Canada project alone cost approximately $375 million. The cost of this project along with the gas industry's gathering and distribution systems is in the neighborhood of one billion dollars. This investment is of significant benefit to every Canadian. The pipeline will help Canada grow stronger internally and more independent and influential internationally.



Present and future compressor stations on Trans-Canada. The compressor stations now being installed and which will be in service during 1958 are marked with arrows. There will eventually be over 20 such stations on the line, and even Alberta Gas Trunk, which is now operating on natural gas pressure alone, will need compressors when pressure drops within a year or two.



Shipment of seven Clark Bros. TLA-10 compressor units to compressor stations at Moosomin, Caron, and Burstall in Saskatchewan: Each unit weighed well over 150 tons and required two railroad gondolas and one extra-heavy capacity flat car. Total weight of entire shipment, which included 10 additional compressor cylinders, was approximately 2,280,000 lb. Twenty-two rail cars were required to transport the entire shipment which made the first leg (Olean, N.Y., to Chicago) of the near transcontinental run in a single train. Total power output of the seven units is 23,800 bhp.



48,500 hp for Trans-Canada

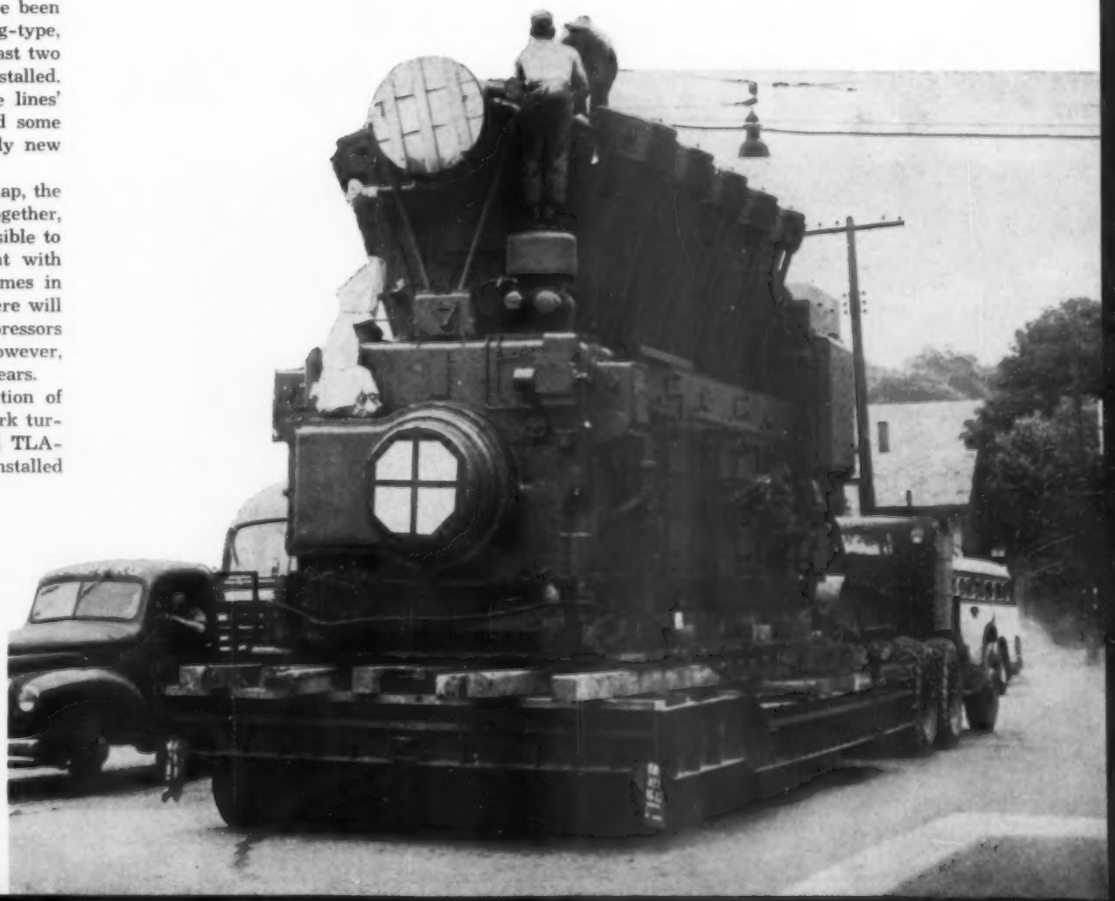
HEART and primer movers of Trans-Canada's gas are the compressor stations which supply the push to carry the gas along its 2,200-mile route. A tremendous amount of push is needed, and it has to be of the most reliable type to operate in the isolated conditions of Canada's northern shield areas.

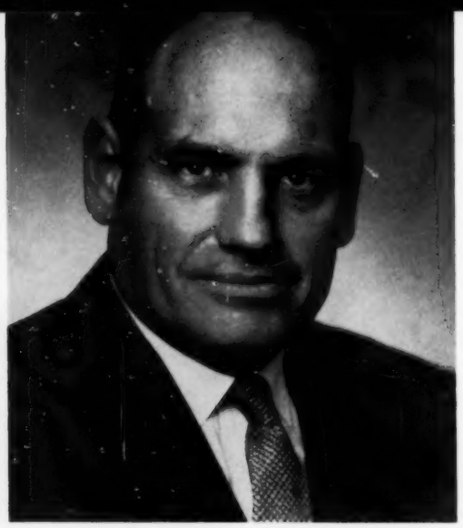
There may ultimately be over 20 compressor stations on Trans-Canada as the line's volume increases. Twelve have been installed to date. All are reciprocating-type, but within the next two years at least two centrifugal compressors will be installed. So far, all the compressors use the lines' gas for fuel. That may change, and some will be run by electricity, especially new stations in northern Ontario.

As shown on the accompanying map, the compressor stations are close together, since in a cold country it is not feasible to spread them. On the hookup point with Alberta Gas Trunkline, the gas comes in without the aid of compressors. There will eventually have to be some compressors used by Alberta Gas Trunkline, however, when pressure drops in one to two years.

Powering the western 34-in. section of Trans-Canada pipeline are nine Clark turbocharged 2-cycle 3,400-bhp model TLA-10's. Three compressors each are installed

Transportation problems to the wilds of the upper Great Lakes region were not easy. Workmen play "low-bridge" here with a Cooper-Bessemer compressor going through a small town.





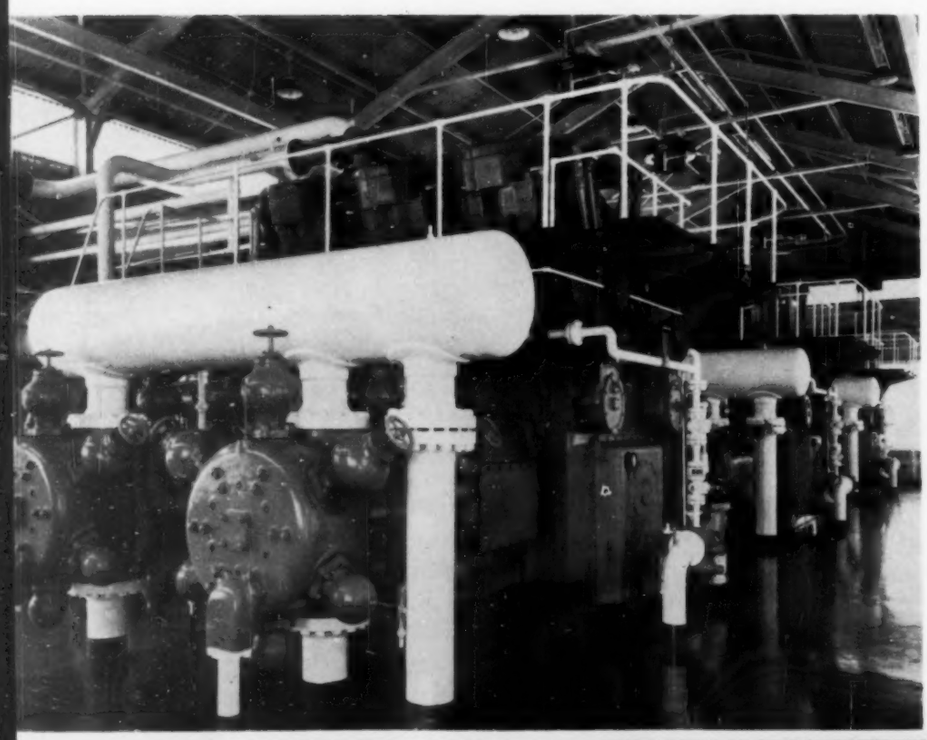
For the past four years one of the busiest men in a very busy country has been a large, placid 46-year-old Texas engineer named CHARLES S. COATES. He is president of Trans-Canada Pipe Lines Ltd., and has the primary responsibility for the construction of the longest natural-gas pipeline in the world.

Mr. Coates, a rugged six-foot three-inch 215-pound ex-footballer (All-Southwest tackle, University of Texas 1933-35), is what Canadians have in mind when they talk about the advantages of American prticipation in the development of Canada.

Mr. Coates came to Trans-Canada from Tennessee Gas Transmission Co., where he had been senior vice president. He had been with Tennessee since the company was formed in 1943, and had major responsibilities in the construction of that company's pipeline network. He was in on the construction of the company's original pipeline from South Texas to West Virginia, and by the time he came to Trans-Canada had supervised engineering and construction of 7,000 miles of natural-gas pipeline in the USA. He is one of the few people in Canada today who has had this kind of experience—the experience necessary to lead a multi-million-dollar pioneer venture to fruition.

NATHAN ELDON TANNER, board chairman for Trans-Canada Pipe Lines Ltd., has had a distinguished career both in government and business. Born in Salt Lake City, Utah, in 1898, of devout Mormon parents, he came with his family to Cardston, southern Alberta, at the age of three months. Resigning as principal of Cardston High School in 1928, he was elected to the provincial legislature as candidate of the then Social Credit party. He was named Minister of Lands and Mines in 1936; and made one of his outstanding contributions in formulating, after the Leduc discovery in 1947, the petroleum legislation which forms the basis on which Alberta's oil industry has prospered. In September 1952, he resigned from the government to become president of Merrill Petroleum Ltd. and, in March 1954, became president of Trans-Canada Pipe Lines Ltd. He views Trans-Canada as an epic milestone in Canadian growth, and has put many long hours into its completion.

Mr. Tanner married the former Sarra Merrill of Cardston. They have five daughters and 19 grandchildren. Mr. Tanner is a director of many other companies, including Toronto-Dominion Bank, National Trust Co., and Alberta Gas Trunk Line Co. He is a member of 13 associations, including Canadian Inst. of Mining and Metallurgy, and Canadian Gas Assn.



Note the bottle-type construction with a hand wheel on the compressor cylinders. These are unloaders for the compressor or valve-cap unloaders to vary the operating pressure conditions of the machine to suit the line equirements, thus enabling the station to maintain full load on the engines for lower fuel consumption and maximum efficiency. Compressor is a Cooper-Bessemer GMWA-10, rated at 2,500 hp.

at stations 2, 13, and 25, located at Burstall, Caron, and Moosomin, in Saskatchewan. The compressors, according to Clark engineers, have been specifically designed for turbocharging. The 10 vertical power cylinders of 17-in. bore and 19-in. stroke are integrally connected to five horizontal compressor cylinders. The power ends are rated at a bmep of 102 psi. Each compressor utilized a single built-in turbocharger to provide air for scavenging and combustion.

The compressor cylinders furnished are of a new design. They are said to be capable of compressing 15% more gas per brake horsepower than any previous pipeline compressor cylinders. Heart of this new cylinder design is a new poppet-type valve. In field tests covering a five-year period, these valves have reportedly operated for periods of over 40,000 hours without requiring servicing or replacement. The compressor cylinders furnished to Trans-Canada are designed for a maximum discharge pressure of 838 psia at a ratio of 1.25. The cylinders incorporate substantial clearance to permit loading over a wide range of conditions.

All suction and discharge headers for the compressors were calculated by Clark on an analog computer to be certain that there would be no standing waves or wave fronts within the headers which might impair compressor cylinder efficiency.

Remainder of the compressors on the line are Cooper-Bessemer units. There are three 1,800-hp model GMVC-10 units at

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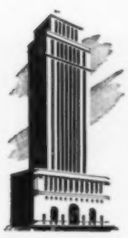

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Typical example of compressor station: The building here houses four GMVA-10 units.

North Bay, two model GMWA-10 units at Port Arthur or the Crown station, and three GMWA-10 units at the Winnipeg station. These units are each rated at 2,500 hp.

Regarding operating conditions on the compressor cylinders, all these units are sized for variable suction compressors from 500 to 760 psig, with a discharge pressure of 920 psig.

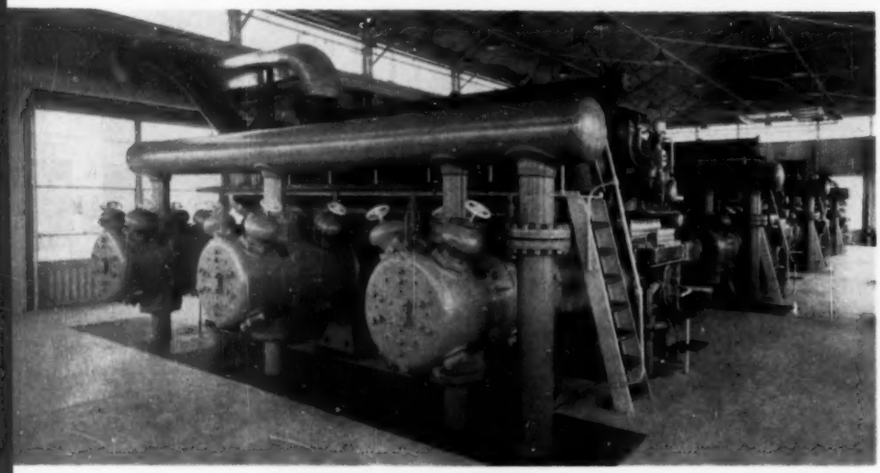
All units are integral and of the V-type having the power cylinder and compressor cylinder operating off the same crank throw, featuring the Cooper-Bessemer patented articulating rod. This rod allows the power cylinders and compressor cylinders to operate in one plane, allowing less space per installed horsepower.

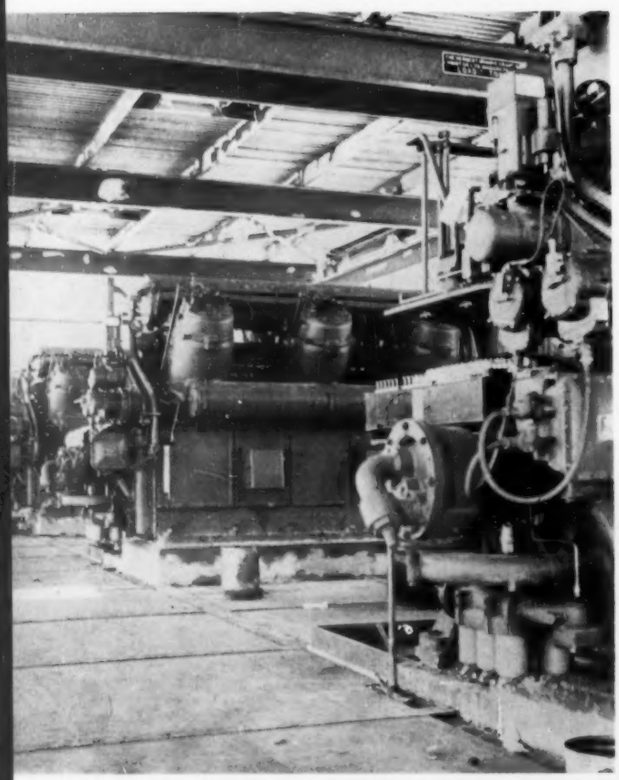
The GMWA-10 units—Winnipeg and Port Arthur—are atmospheric-type engines capable of being supercharged later at the site to 3,500 hp rating. The existing design is such that all piping and auxiliaries are designed to facilitate additional rating.

All of these units operate on natural gas and obtain their fuel from the pipeline. All units are heavy-duty slow-speed-type capable of operating 24 hours daily with the minimum of downtime requirements. All of the compressor stations have been designed to facilitate additional units when the growth of Trans-Canada warrants additional gas to be pumped through the line.

END

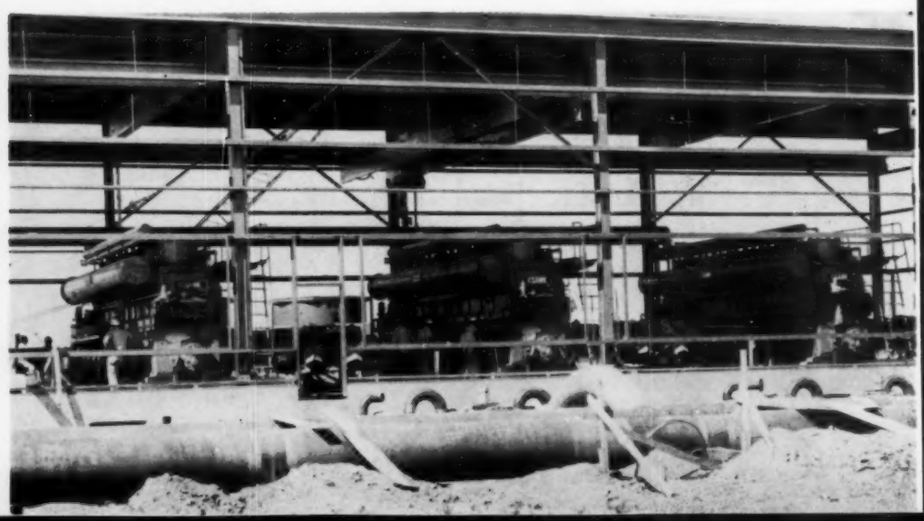
GMVC units of Cooper-Bessemer design as used in the North Bay station.





Left: North Bay, Ontario, compressor station for Trans-Canada Pipe Lines natural-gas line from Alberta to Montreal is one of six stations being built in 1958. Here three 1,700-hp Cooper-Bessemer engines, using natural gas for fuel, have been installed to provide the pressure boosting required for initial flows. Three of the compressor stations which will move the gas through the 2,330-mile pipeline are being built in Saskatchewan; one in Manitoba; one by Northern Ontario Pipe Line Crown Corp., at the lakehead; and the other, at North Bay, is being built by Trans-Canada. Cost of stations averages $3 million each.

Compressors being installed on the Trans-Canada line. These are the Clark turbocharged 2-cycle Model TLA, a right angle gas-engine-driven unit. The TLA develops 3,400 hp.



Pre-Cambrian problems on Trans-Canada job

by **Leslie Orr Rowland**
Editor, *Oil in Canada*

The world's longest gas line was also the toughest to dig, especially where the vast Canadian Shield, an extruded portion of the earth's core, forms a nearly impenetrable mass.

ABOUT 50 miles east of Winnipeg on the route of the Trans-Canada natural-gas pipeline occurs the most westerly outcrop of the Pre-Cabrian igneous granite rock which composes the Canadian Shield, a vast spread of the earth's core extruded to the surface during past periods of volcanic activity. This tremendous granite mass lies unconformably under the entire pipeline route from that point to its final destination in Montreal. For many long stretches it is covered by swamp or muskeg to such a depth that it is not a factor in the pipeline construction. However, for nearly half the total pipeline mileage between Hadashville, Manitoba, and Montreal, Quebec, construction spreads have had to contend with rock, varying in thickness from a few inches at the bottom of the ditch depth to rugged outcrops as much as 1,400 ft high. Altogether approximately 350 miles of the line, including both the wholly owned Trans-Canada sections and the portion of the line being built by Northern Ontario Pipe Line Crown Corp. for lease with option to purchase, involve rock ditch.

This situation has imposed on the contractors several interesting and sometimes rather difficult construction specifications and methods which have been adapted from standard pipeline rock-ditch practice to meet the special conditions encountered in the Canadian Shield.

The basic problem of this rock devolves around its peculiar composition. It is more homogeneous than any other granite encountered in pipeline construction anywhere in the world, according to veteran pipeliners who have laid pipe in most of the world's pipeline regions. Most of the Canadian granite contains no fracture planes to speak of; so that, when it is drilled and shot, there is a tendency for much of it to break up in very large pieces. Some rock fragments left on the right-of-way after shooting for finished ditch are more than a cubic yard in size and make a fairly full load for a Cat D9 bulldozer to push off. This presents problems for backfilling, as will be seen later.

Trans-Canada's specifications—which include the Crown line construction—call for full rock shielding through all rock ditch, including areas of full rock shooting and

Portage La Prairie, Manitoba: The line is shown crossing Assiniboine River.

also any parts of the line where rock fragments will be found in the backfill even if no rock is actually present in the bottom of the ditch. They also require ditch-bottom protection in the form of sandbags, laid in groups of three across the width of the ditch, at intervals of 20 ft, or two sets for each pipe joint.

Because of the impossibility of getting natural materials for padding around the pipe in most of the rock areas, without imposing an excessive cost burden for transportation from areas where they could be obtained, the contractors have been permitted to backfill directly with the excavated material. They have had to provide protection, however, with lizards or "shedders" to minimize the impact of backfill on the pipe wrap.

The construction procedure and methods are fairly uniform all along the line, but minor modifications have been worked out by different contractors according to local variations in the terrain and in the degree of breaking up of rock in shooting right-of-way ditch.

After the pipe is wrapped with the conventional inner and outer wrap (four types of wrap are being used to distribute business among different manufacturers) special rock shield is taped on with steel bands. The rock shield is a heavy asphaltic felt manufactured by Crose-Curran Ltd., of Edmonton, and is standard for the entire line. Pipe is all skidded from the wrapping machine and is rock-shielded while on the skids.

Lowering-in is done by the tie-in gang or by a special lowering-in gang, depending on spread organization. Great care is taken to avoid bruising the rock shield on the sides of the ditch as the pipe is lowered onto the sandbags. In most cases the rock-shield gang works in the ditch as the pipe is cradled over the ditch, to fasten the steel bands, so that there is a minimum of handling time during the actual lowering-in.

The usual method of backfill is to suspend a lizard from a sideboom tractor of the Cat D7 or MD7 class, using a half-section of casing of a slightly larger diameter

Cement-weighted pipe 18 ft below the Assiniboine River near Miniota, Michigan. A small pump kept the area free of seepage, by pumping the water back to the river. Temperature, 22° below. (Trans-Canada photo).

A one-yard backhoe working on the Temagami, Ontario portion.

Clearing slabs of granite from the right-of-way in eastern Manitoba. After this a ditch four and one-half feet deep was dug for the pipe. (Trans-Canada photo).

than the 30-in. pipe as the lizard. This casing, varying from 10 ft to 20 ft long, is hung by a steel cable attached to welded grab hooks at both ends. The sideboom tractor walks along the working side of the ditch, carrying the lizard a few inches above the pipe, while the backfill tractor works from the backfill side of the ditch. The usual backfill tractor used is a D8 or the equivalent, and in some cases two tractors work together, equipped with bulldozer blades. As the bulldozer pushes the backfill over the edge of the ditch, the rocks fall onto the lizard, which breaks the impact; and, as the lizard is pulled slowly along the pipe, the backfill falls gently off the back end and fills in around the pipe.

The bulldozer operator has to exercise good judgment in selecting the smaller pieces of rock and loose material for the initial fill. The larger pieces are used for the secondary fill. Some contractors have used two bulldozers, one handling entirely the first pass and the second following.

In practice, it has been found that the space between the pipe and the ditch sides is quite enough to permit complete packing with backfill material by this method, and that enough falls down to the bottom of the ditch to give adequate support to the pipe between the sandbag packs.

In a few places, where rock has broken up exceptionally well, contractors have used conventional backfillers with swing scoops, or draglines with regular dragline buckets, working from the right-hand side of the right-of-way, instead of bulldozers; but this method has been feasible for only a small proportion of the total rock mileage. It also tends to complicate the handling of the lizards, which can be done much more easily when the backfill machine is working from the opposite side of the ditch, as is the case when bulldozers are used.

Backfilling can be done at a rate of close to a mile a day using only one set of equipment, but in cases where contractors have got behind the rest of the spread with their backfill a second lizard and a second or third bulldozer have sometimes been used for as much as 50% extra footage. END

Drilling on the Temagami, Ontario portion (Bechtel Photo).

Red River crossing, Winnipeg, Manitoba.

Trans-Canada technician receives a radio-telephone message to change a valve setting along the pipeline route.

Trans-Canada's communications

NOT ONE but two separate telephone networks are providing the Trans-Canada Pipeline Co. with a rapid and flexible communications system along its 2,300-mile route.

Believed to be among the longest private line circuits for pipeline operations in North America, the two networks were engineered and installed by the member organizations of the Trans-Canada Telephone System, which comprises the nation's major telephone organizations and coordinates the engineering, construction, and operation of long-distance telephone service from coast to coast. Ontario Northland Communications also took part in building the circuits over their own territory—the rugged, rocky terrain of northern Ontario.

The actual construction of the telephone circuits evolved as a flexible arrangement over the past three years in order to meet the changing needs of the pipeline company. One system, for example, although primarily designed as an operating line, became a communications network used mainly by the construction and testing crews during the building of the pipeline. The other, originally designed for administrative purposes only, will be converted, when the pipeline is finished in the fall of 1958, to form the backbone communications facilities for pipeline operations.

This highly flexible use of the communication system began in 1956, when it was decided to build the pipeline in sections. It was agreed that each would have its own telephone communications network consisting of a multi-point private-line circuit. Fixed telephone terminals and radio base stations for mobile telephone services were required over each section, and were provided by the telephone organizations taking part in the project.

As a result, five separate circuits were designed to meet the requirements of the pipeline company. The initial circuit was provided across the western province of Saskatchewan; the next was a similarly designed circuit across the neighboring province of Manitoba; and the third was installed to serve the section of pipeline built from the Manitoba border east to Port Arthur· Ontario. Shortly afterwards, a separate circuit was provided to meet the pipeline building requirements between Toronto and Montreal, and the fifth and last circuit was installed by the spring of 1958 to give communication facilities to the huge section from Port Arthur, at the head of the Great Lakes, to Toronto on Lake Ontario.

In order to make use of existing telephone buildings and facilities, the antennae and associated radio apparatus for the radio base stations—each about 60 miles

apart—were mounted on microwave towers, exchanges, and mobile telephone sites.

In addition, a dispatching office was established for each of the five circuits, with the dispatcher able to make telephone-to-telephone, telephone-to-vehicle, and vehicle-to-vehicle connections.

On completion of the final circuit, Trans-Canada had, in effect, five separate circuits covering a total of 2,300 miles from the Alberta-Saskatchewan border to Montreal, Quebec. Two spur lines were also built, one following the pipeline spur from Morrisburg, on the St. Lawrence River, to Ottawa, Ontario, and the other extending along a second pipeline spur from Toronto to Niagara Falls, which is connected with another pipeline company on the American side of the border.

In all, 43 radio base stations were required to provide mobile radiotelephone coverage over the five circuits, with some 180 vehicles equipped to use the service at present. About 15 telephone terminals were also established along the entire network.

The Trans-Canada Pipeline Co. holds its own government license to operate the radio system in the 160 M/c band, but all equipment for this radiotelephone service was leased and is being maintained by the telephone organizations taking part in the project.

While this sectionalized circuit was being built to meet the operation and construction needs of the pipeline, a second 2,200-mile multipoint private line was established to connect the various administrative offices between Calgary, Alberta, and Toronto, Ontario.

Completed by July 1957, this circuit was carefully designed to do two things: (1) provide an immediate communications system for administrative purposes, and (2) be easily converted, when construction of the pipeline was finished, to become the main or backbone circuit for pipeline operations.

The conversion of the circuit will coincide with the full operation of the pipeline this fall. As such, it will connect 11 points along the pipeline route. These points include the two chief administrative offices, six compressor-station sites, and three divisional offices across the 2,200-mile system.

At present, this backbone system will operate via a coded ringing arrangement only, but plans are afoot to provide a dial selective signaling service between all access points shortly, since it is believed this system will be in operation before the spring of 1959. Such an installation will provide several features to insure the rapid, flexible, and efficient use of the circuit.

For one thing, the chief dispatcher at Toronto will have an all-call code number as well as individual code numbers for each of the access stations. A special "beep" signal is also being installed so that he might clear the circuit of all calls for emergency purposes.

Other safety and alarm features are to be installed at the compressor-station points. Each station, for example, will be equipped to receive messages from the main dispatching office at three distinct locations. During regular office hours, calls to the station will be received at the station office; but after hours, they will be channeled to an auxiliary building next to the compressor room, which has been carefully equipped with extra-loud bell signals both in and outdoors. A further safety factor has been added in that, if the auxiliary building signal is not answered within two minutes, the ringing will automatically switch over to a telephone in a designated residence of one of the officials of the station. Three homes at each compressor site are wired to take such calls.

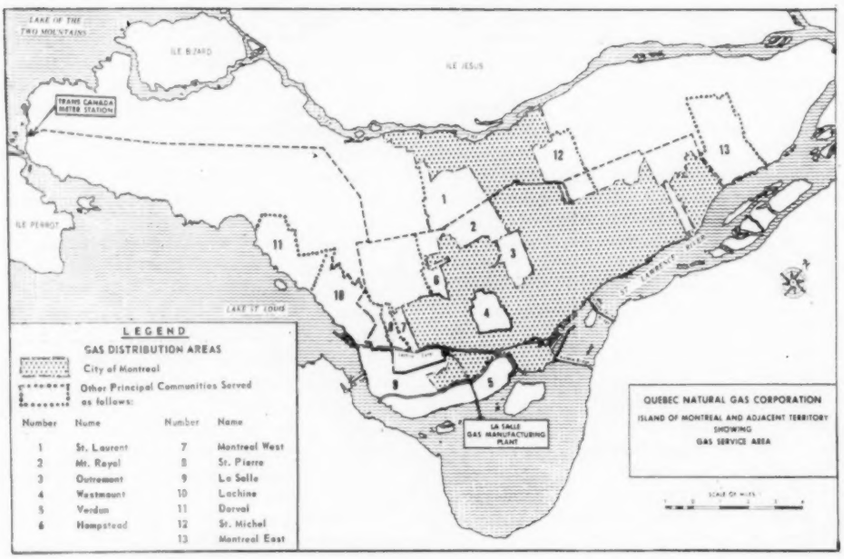
A dial intercom system is also being established at each of the six compressor stations to provide communication between all buildings located within the confines of the station.

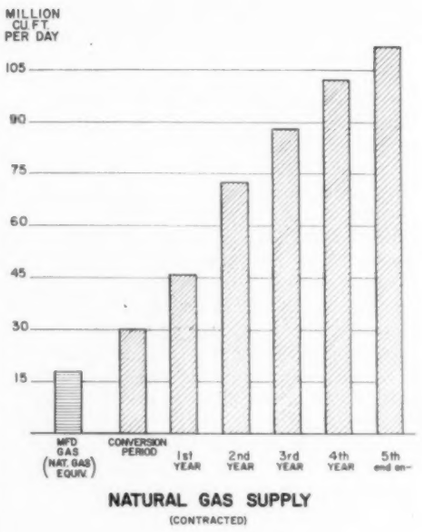
The five sectional circuits, which played such an important role during the construction phase of the pipeline project, will continue to be an integral part of the communications system for the company. Already equipped with a dial signaling system, these circuits will form a secondary communications network for use by divisional personnel, enabling them to connect with any telephone or radio base station within their own section.

By this means, operators of vehicles with mobile telephone units will be contacted by the dispatcher through a paging system. They, in turn, will be able to contact the dispatcher by pressing a button on their mobile telephone unit. Each dispatcher will also have a connecting line to the main or backbone circuit of the company.

Throughout the construction period, too, a teletype service was maintained by the member organizations of the Trans-Canada Telephone System to facilitate the sending of progress reports and other information on the actual building of the pipeline. END

Console at Trans-Canada's Napanee, Ont., district office, which can make connections from telephone to telephone, radiotelephone to telephone, and between two radio telephones.





Quebec Natural grows

by Colonel Maurice Forget

One of the areas to be supplied with Trans-Canada's gas lies within the perimeter of Quebec Natural Gas Corp. The author here describes the company's prospects and plans for a growing natural-gas consumer market in Greater Montreal.

Colonel PIERRE MAURICE RODOLPHE FORGET, president of Quebec Natural Gas Corp., is a native of Montreal, the son of Sir Rodolphe and Lady Blanche MacDonald Forget. Educated at Mt. St. Louis and St. Mary's Colleges and the University of Montreal, with B.A. and LL.B. degrees, he practiced law for five years. In 1927 he left law practice to found the investment partnership of Leclerc & Forget. In 1929, having bought out the partnership, he founded the firms of Forget & Forget and Forget & Forget Ltd., of which he is president. He has been a member, director, or chairman of numerous Canadian industrial, utility, and investment firms—including Canadian Commodity and Montreal Stock Exchanges. He also has been commissioner of the Province of Quebec Highways Commission. A World War II veteran, he also served for four years as Canadian military attaché to the French government.

BEGINNING with about 250,000 customers on the island of Montreal, Quebec Natural Gas Corp. expects its eventual market to cover all of metropolitan Greater Montreal, an area of 1,891 square miles (Fig. 1). Present population of 1,600,000 in the area is expected to rise to 2,500,000 by about 1971. The potential market will include service to the South Shore communities, where industrial developments due to completion of the St. Lawrence Seaway will result in increased natural-gas consumption.

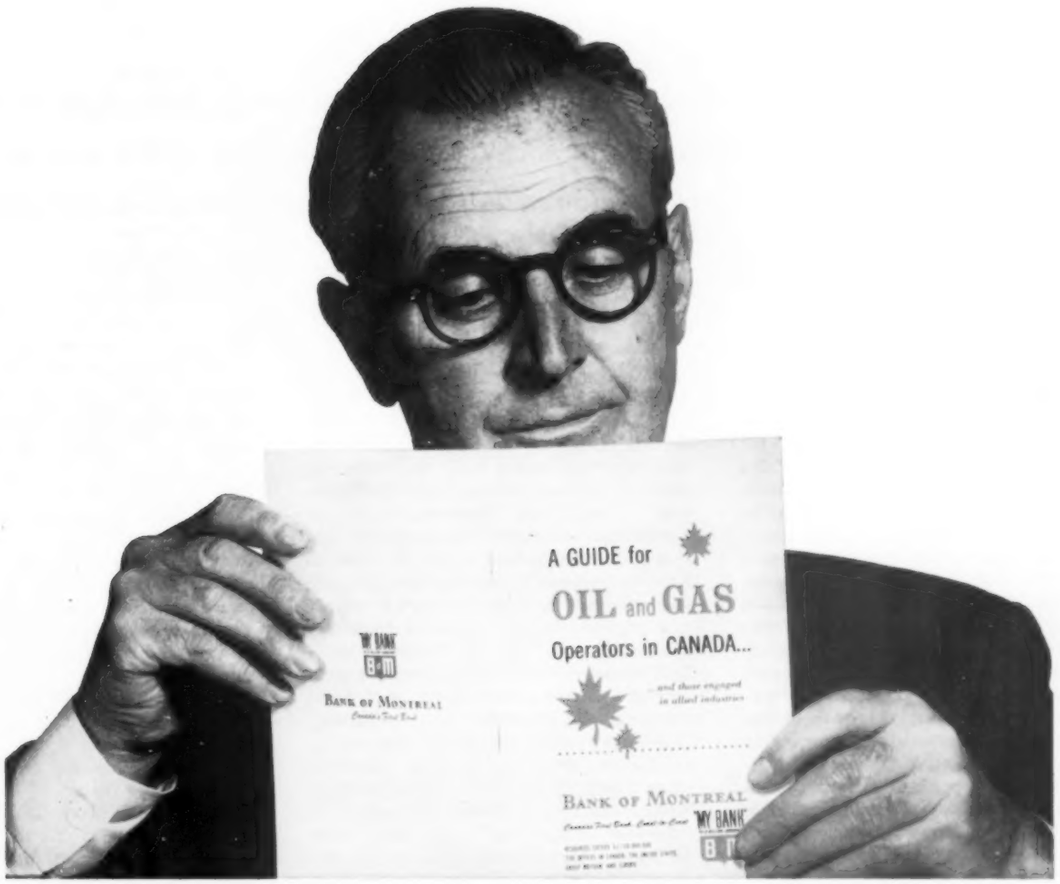
Quebec Natural Gas, by the end of October, will have been in operation 18 months from the time of its acquisition of Hydro-Quebec's manufactured-gas distribution system and of the assets of Montreal Coke Manufacturing Co. and Keystone Transports Ltd. in April 1957. Based on the results of early months of operation, a tenfold increase in gas sales is foreseen by 1962, compared to Hydro-Quebec's output for 1956—its last full year of manufactured-gas production and sales (Fig. 2).

As early as December—less than eight months from purchase date—Quebec Natural Gas had completed installation of a 34-mile distribution line of 20-in. to 16-in. diameter from Senneville in the western part of the island of Montreal, connecting point with the Trans-Canada Pipe Lines' supply source, to the eastern extremity of the island. This header is already supplying the existing system at several strategic points, and future expansion is foreseen.

The corporation has been supplying its customers with natural gas since May, except for a restricted area in Ville La-Salle, site of the Montreal coke plant. This means conversion was effected in less than four months. The conversion operation involved 1,300,000 adjustments for 250,000 customers, and the change from manufactured to natural gas has resulted in an estimated $1,800,000 saving on the anticipated $7 million installation costs.

Since February 1, headquarters of Quebec Natural Gas have been located in a new building, with 200,000 square feet of floor space, on the Montreal-Dorval highway. Personnel has increased to 1,265 from the 711 employees transferred from Hydro-Quebec. Annual payroll already is $6 million. Working conditions equal those of

(Continued on page 70)



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OIL IN SIBERIA

A vast arterial network of pipelines is being built to supply Siberia and Soviet Asia. The potential of this area is great, and over half of Russia's investment is now going into it.

by G. G. Rosu

THE INDUSTRIALIZATION of Siberia and the central Asian republics in the long run may have a greater influence upon the economic and political equilibrium of the world than, for instance, the ventures in cosmic space. These regions started to be shaken from their age-old inertness only since 1953, and now half of Russia's annual investment fund is plugged into Soviet Asia. This proportion may be substantially raised in future years. Prior to 1950, only the brim of this vast subcontinent (which covers 6.4 million square miles, and makes up 75% of Soviet Union's territory) was surveyed. The first geological map of this area, drawn two years ago, shows only scattered blank spots.

Albeit weighty political advantages, in due course, will accrue to Russia out of it, the plan for developing the economy of Soviet Asia was not spurred by political motivation, but by stringent economic difficulties at home. One of this plan's facets —and the most publicized yet—was the cultivation of vast arid lands in Kazakhstan and Altai. However great the sacrifices and efforts made and, by Western standards, however highhanded the methods used to achieve it, it is none the less true that the crops of these "virgin lands" have solved the food problems of the Soviet orbit which, heretofore, had been its most vulnerable spot.

The truth is that the primary aim of the plan for Soviet Asia's industrialization is to solve a gamut of critical bottlenecks which, after the last war, have compounded into an untenable situation. The most acute one is the precarious fuel balance of the European part of Russia: Its fuel and power engineering base is lagging badly behind the growing demands of industry, transport, and public utilities. This shortage was temporarily alleviated by increasing coal production in the Donbas, Moscow, and the Ukrainian basins by laying a gas-line network as well as by carrying Ural-Volga crude oil by pipeline deeply into European Russia. Ever since the inception of Soviet planning, most of Russia's new processing and manufacturing plants have been crowded into the region west of the Volga. Three-fourths of the Soviet machine-building industry, for example, is concentrated there, and now its capacity exceeds by far the local fuel and raw-material base. An attempt to supply this region with raw materials from faraway places has resulted in transportation bottlenecks as well as having caused a great rise in the production costs of finished products. The expansion into Soviet Asia thus became unavoidable if further industrialization were not to be arrested. In other words, the economic development of Siberia was Russia's Hobson's choice.

Serious exploratory work done there during the past five years led to the discovery of vast mineral resources. At present, 75% of the total coal reserves, 80% of the hydroelectric potential, 80% of the timber wealth, as well as Russia's main reserves of nonferrous and rare metals, are located in Soviet Asia. Computed per unit of production, mining and development of these resources require half, or even less, capital than if similar potentials were developed in the European part of Russia. The industrialization of Siberia is, thus, an excellent investment which results in a twofold advantage: a better use made of the Soviet annual accumulation rate, i.e., faster economic growth with the same amount of capital, and lower production costs which are enhancing the Soviet competitive capacity on the world market.

The blueprints of the next two or three Five-Year Plans provide for the construction of four large iron and steel combines in Soviet Asia, a series of huge hydroelectric power plants, some 200 machine-building plants, as well as for opening of tremendous mining districts. The reverse side of the coin reveals, however, that these expected advantages will be bought at a high initial cost. Indeed, for years to come, large amounts of capital will be absorbed by new railroads, pipelines, new settlements for the manpower which is pouring into these sparsely populated regions at an annual rate of half a million workers, etc. These preliminary investments will certainly slacken the initial progress. Another price has already been paid to attain this goal of industrializing Soviet Asia. It consisted in the need to revamp the whole Soviet economic scaffoldings, and to decentralize the industrial management[1]. In addition to disrupting the entire Soviet bureaucracy, this reform has, knowingly, required also a heavy toll in prestige and power paid by several political personalities.

However high the initial costs may be, it cannot be denied that the industrialization of Soviet Asia is the most important economic phenomenon in the world since the last war—bound to have deep geopolitical repercussions. In another decade, Russia will have in this region a powerful supply base to back up its drive for dominating the markets of Southeast Asia and the Middle East.

How will the industries to be built in Soviet Asia be fueled, To start with, its own oil production is insufficient to satisfy even the present modest demands of a still undeveloped industrial activity. Targets set for 1960 show the following increases as compared with the 1955 achievements (figures in millions of barrels):

	1955	*Plan 1960*
RSFSR (Russian Federation)	354.7	784.3
Turkmen	22.5	29.4
Kazakh	10.1	14.2
Uzbek	7.2	10.8
Kirghiz	0.8	6.5
Tadzhik	0.1	0.2

The RSFSR 1955 production figure of 354.7 million barrels is an accumulation of the contributions of:

the Ural-Volga region of 240.0 mil. barrels
Transcaucasus and Northcaucasus, approximately 85.0 " "
Sakhalin 9.3 " "
while the balance of 20.4 " "

represents the production of the westen districts of the European part of the RSFSR, located west of the Volga-Dvina and north of Don, as well as that of Siberia proper. Therefore, the crude output of Soviet Asia amounted in 1955 to approximately 60 mil-

[1]*See: "A New Soviet Oil Management," WORLD PETROLEUM, September 1957, p. 130-134; by G. G. Rosu.*

lion barrels, of which two-thirds originated from the central Asian republics, and one-third from Siberia. The paucity of the local oil production is supplemented by large quantities brought in from the Ural-Volga region.

What are Soviet Asia's prospects for attaining self-sufficiency in liquid fuels in the near future? Judging by the 1960 targets, the Ural-Volga region is slated to remain the biggest producer of both Russia as well as RSFSR. Indeed, its output in 1955 amounted to 610,000 b/d compared with a total Soviet production of 1,395,000 b/d; this left for all the other Soviet oil fields a cumulative share of 785,000 b/d. In 1960, the production of Ural-Volga is planned to go up to 1,900,000 b/d, compared with a total production of 2,686,000 b/d; the target set for all the other producing areas is thus of 786,000 b/d, or 1,000 b/d higher than five years ago. This modest increase has been assigned to three central Asian republics: Turkmen, Kazakh, and Kirghiz. The picture is now clear: While the overall industrial production of Soviet Asia is planned to increase 2.2 times between 1955 and 1960, its own oil production will go up by a mere 20 million barrels. It is thus beyond a doubt that this region will have to rely to a far larger extent upon outside supply sources—primarily on Ural-Volga oil—than in the past.

For the past quarter century, the supply pattern of Soviet Asia remained almost unchanged. Central Asia's modest oil consumption, for instance, was covered by crude oil from Baku shipped across the Caspian Sea to the Krasnoyarsk and Nefte Dagh refineries. The latter processed additional crude oil received from the adjacent Cheleken Island and from the Nefte Dagh oil fields. The products processed in those two plants were sent through the Krasnoyarsk-Ashkhabad pipeline, and then by rail to the consumption centers in Turkmen and Uzbek. In the south, the crude production of the Fergana Valley, processed in the four local refineries, sufficed to cover the requirements of the Tadzhik and Kirghiz republics, as well as those of the southern provinces of Kazakhstan. In the northwest, consumption was easily satisfied from the fields along the North Caspian coast.

A similar peripheral supply pattern was instituted long ago for Siberia with the difference that, owing to railroad transportation over long distances, the price of oil products at destination became almost double. Siberia's main supply source was also Caspica, i.e., Baku, Grosny, and Gurev, from which points oil products were sent to adjacent pipelines and railroad points. From here, oil was carried on the Trans-Sib Line all the way to Irkutsk and Chita provinces over thousands of miles by tank cars. The small Sakhalin[2] production hardly sufficed to cover the needs of Khabarovsk and the Pacific fleet.

[2]*See: Oil in the Soviet Far East and Sakhalin, WORLD PETROLEUM, January 1957, pp. 40-42; by G. G. Rosu.*

Middle and northern Siberia, as well as the arctic shipping activities, were supplied from the Ukhta region alone; products were shipped from here to the White and Kara Seas and, thence, to terminals on the Siberian rivers—on which, however, navigation is practiced only three months of the year.

But this peripheral supply pattern is no longer able to meet the oil requirements of a rapidly expanding Soviet Asian economy. Oil consumption of southern Siberia is already soaring. The Pacific Coast is following suit, while the demands of the northern coast and the arctic ocean shipping route will soon score substantial increases as well. A new supply pattern has been thought out to cope with the future oil consumption, which consists of a radical change in the transportation methods as well as in developing local oil resources. Briefly, the new scheme aims at creating permanent supply sources of abundant and cheap oil for each one of the existing and planned industrial centers of Soviet Asia.

The first change in the old pattern consists in what is officially called "the saturation of Siberia and central Asia with transportation arteries." The main artery is a set of pipelines running from the Ural-Volga region along the southern Siberian border. When finished, the Tuimaza-Irkutsk pipelines (between 20 in. and 30 in. in diameter) will have a carrying capacity upwards of 550 million barrels per annum. Oil is pushed by powerful pumping stations controlled automatically from Ufa. The first leg of this artery to Omsk is already in operation. The northern two lines carry mainly crude oil from the Tartar and Bashkir fields to the Omsk refinery, while the southern line is already distributing products from Bashkir refineries to consumption centers in Kazakhstan's northern provinces. From the latter line, two new branchings, running meridionally, will be completed soon to carry products to the "virgin lands" in Akmolinsk, Karaganda, and Pavlodar.

From Omsk, a single pipeline will carry crude oil to Irkutsk. This line is slated for completion in, or before, 1960, simultaneously with the going onstream of all the installations of the refinery under construction at Angarsk, near Irkutsk, which will become Siberia's largest processing unit. Plans are already afoot to extend this line—after 1960—parallel with the Yuzh-Sib Line as far as Khabarovsk.

It has been calculated that the cost of pipeline transportation is only one-third the railroad bill. The cost differences thus realized will help writing off quickly the capital invested in laying the Tuimaza-Irkutsk-Khabarovsk pipelines. Afterwards, the oil cost at Siberian consumption centers will become substantially lower than it is at present.

The Ural-Volga oil carried through the southern Siberian pipelines will, under the new scheme, supply also the vast expanse of middle Siberia over Irtysh, Ob, Yenisei (both connected by a canal), Angara, Lena (which is now navigable as far south as the new port built at Osetrovo), Amur, and the tributaries of the former, as well as along the Skovorodino-Yakutsk-Khandiga-Magadan highway. A new railroad is planned to be built soon from the Trans-Siberian northwards to Irkutsk to run parallel with the highway. This railroad later will extend to the Kolyma region, where large mining projects for nonferrous and rare metals are being commenced. Another long track, which will be started after 1960, will cross Siberia from the Ural slopes to Yakutsk, almost at the height of the 60-deg parallel of latitude. There is even talk about a railroad along the Yenisei River, though no details so far have been disclosed about this project.

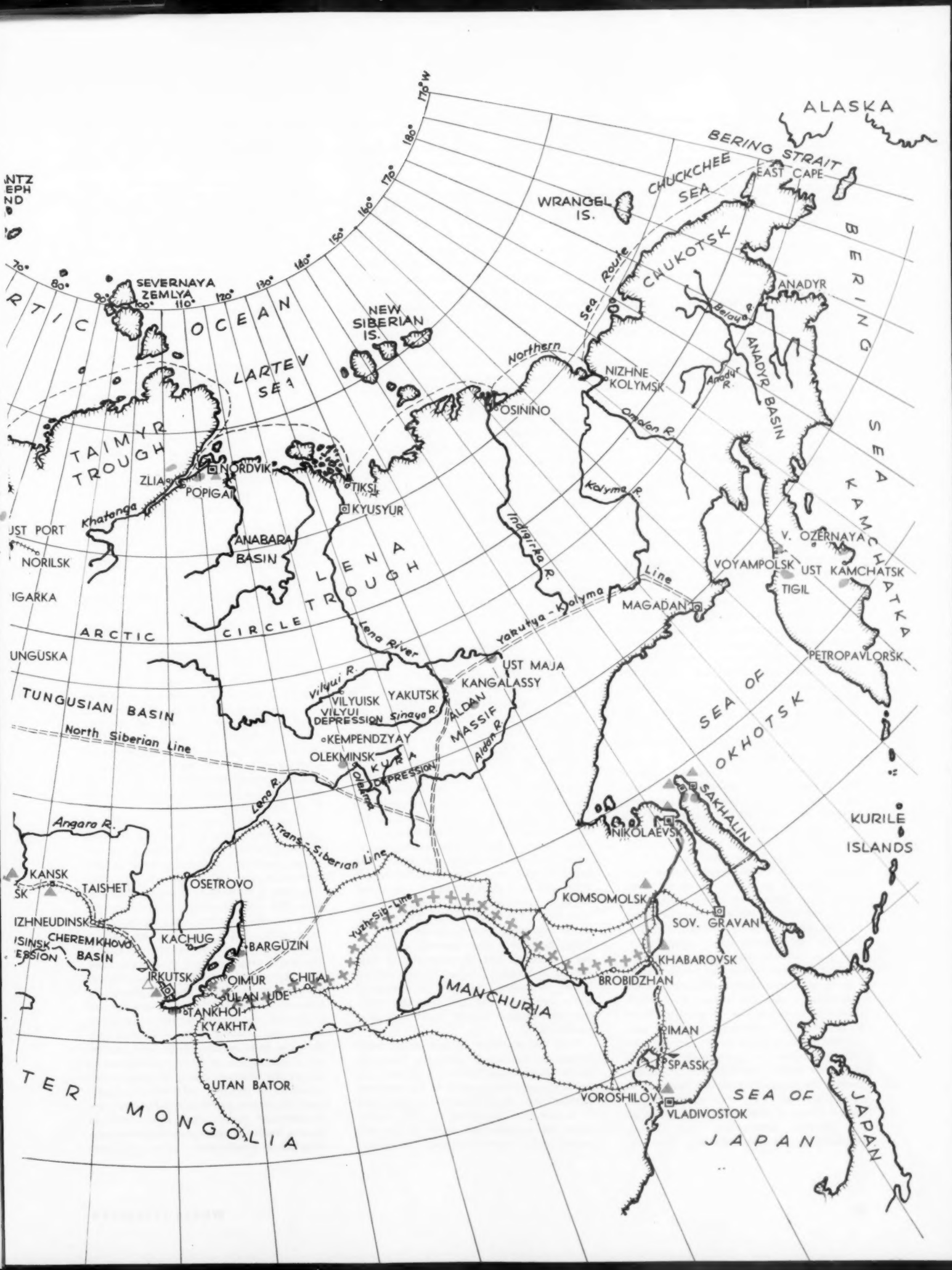
Notwithstanding all these plans, the principal transportation arteries in the vast area north of a line drawn from Komsomolsk on the Amur to Sverdlovsk in the Urals will remain the Siberian rivers which are frozen the greater part of the year. The same is true to a greater extent with respect to the arctic shipping route which, in spite of the heavy limitations imposed by the climate, is being increasingly used for transporting goods and passengers from the Baltic and Murmansk ports as far as Yakutia—even to the Pacific Coast. During the past three years, a higher proportion of goods' traffic with eastern Europe, for instance, is being diverted over the Arctic Ocean. To cope with this expanding haulage, the Far Eastern, Eastern Arctic, Chukotka, Kamchatka, and Sakhalin Shipping Administrations have been recently merged into a single Far Eastern Maritime Shipping Administration. Its fleet tonnage is constantly being increased, and its routes extended from the Baltic and Black Sea ports to China and India, via the Arctic.

As the Kola peninsula is devoid of petroleum and natural gas, oil products for the northern fleet are supplied from Ukhta and Ekostrovsk fields, in the Komi republic, to the northern terminals in the European part of Russia. Further oil supplies are sent by river tankers from the Ural-Volga region with which it is connected (as it is with Moscow and Leningrad) by the Volga River and the enlarged northern canal network which ends at the White Sea. From here, the river tankers continue their voyage to Yakutsk and farther points on the upper Lena, but only during the very brief navigational season.

The second radical change in the supply pattern of Siberia consists in supplementing the oil flow from Ural-Volga by production from local oil deposits. For this purpose, the search for favorable structures has been greatly intensified, particularly within the confines of the East Siberian Oil and Gas Geological Trust, the area of which extends from Yenisei to the Pacific, and from Yakutia to Manchuria. Prospecting is carried out by the following geological entities, the locales of which are indicative of the areas in which the government has a particular interest.

The Arctic Institute of the USSR Acad-

WORLD PETROLEUM MAP OF SIBERIA AND CENTRAL ASIA
OIL DISTRICTS
OIL PIPE LINES
PROJECTED OIL PIPE LINES
GAS PIPE LINES
SHIPPING ROUTES
REFINERIES
REFINERIES UNDER CONSTRUCTION
TERMINI
DISTRIBUTING CENTERS
SYNTHETIC PLANTS (OIL FROM COAL)
SYNTHETIC PLANTS UNDER CONSTRUCTION
RAILROADS
PROJECTED RAILROADS
NATIONAL FRONTIERS
PROJECTED GAS PIPE LINES
PRODUCT LINES
PROJECTED PRODUCT LINES
MURMANSK
BARENTS SEA
KEM
ONEGA
ARCHANGELSK
Northern Sea Route
NOVAYA ZEMLYA
KARA SEA
ARCHANGEL
KOMI A.S.S.R.
MARYAN MAR
AMDERMA
YAMAL
VORKUTA
URAL MTS
Ob R.
BERESOVO
DUDINK
WEST SIBERIAN PLATFORM
TURGAI BASIN
Taz R.
Pur R.
Yenisei R.
Ob R.
Tobol R.
Irtysh R.
Ob-Yenisei Canal
BLACK SEA
Don R.
ROSTOV
KRASNODAR
TUAPSE
MAIKOP
ARMAVIR
STALINGRAD
SARATOV
SYZRAN
Volga R.
KUIBYSHEV
SARAPUL
PERM
N. TAGIL
TUIMAXY
URAL-VOLGA BASIN
UFA
SVERDLOVSK
TYUMEN
STAVROPOL
SALT DOMES
Ural R.
STEHLITAMAK
CHALYABINSK
BATUMI
GROZNY
ASTRAKHAN
CHKALOV
MAGNITOGORSK
TROITSK
KURGAN
TBILISI
NOVOBOGATINSK
GUREV
DESSOR
MAKAT
ORSK
KARTALY
PETROPAVLOVS
AKTYUBINSK
MAKHACHKALA
IZBERBASH
KULSARY
KOSHAGYL
Emba R.
ISILKUL
OMSK
TATARSK
KIROVABAD
TURKEY
CASPIAN SEA
BAKU
UST-URT BASIN
TURGAI
ATBASAR
TOMSK
NOVOSIBIRSK
MARINSK
ARALSK
AKMOLINSK
PAVLODAR
KEMEROVO
ACHINSK
KRASNOYA
KURNETSK BASIN
KOLUNDA
BARNAUL
STALINSK
ABAKAN
KRASNOVODSK
LAKE ARAL
KUNGTAD
HEFTEDAG
Sary R.
KARAGANDA
GOLODNAY STEP
KYAYL
ARVAT
TASHAUZ
KAY
PORDA
UST KAMENOGORSK
LENINOGORSK
IRAN
KHIVA
KARA KUM
KYZYL KUM
Syr Dar'ya
Chu R.
BALKHASH
BALKHASH LINE
ASHKHABAD
DZHEGACHI
TURKESTAN
AKTOGAI
CHARDZHOU
DZHAMBUL
FRUNZE
TURK-SIB
BUKHARA
SAMARKAND
TASHKENT
KHODAHAMBAS
LENINABAD
ALMA ATA
KARSHI
BAISUK
KANIBADAM
LENINSK
KOKAND
ISSYK KUL L.
TERMEZ
STALINBAD
TYUBE
KULYAB
FERGANA
URUMCHI
MAZAR-I-SHARIF
KIROVABAD
AFGHNISTAN
INDIA
CHINA


ALASKA
BERING STRAIT
EAST CAPE
CHUCKCHEE SEA
WRANGEL IS.
BERING SEA
CHUKOTSK
Sea Route
ANADYR
Belaya R.
ANADYR BASIN
Anadyr R.
NEW SIBERIAN IS.
Northern
NIZHNE KOLYMSK
OSINONO
Omolon R.
Kolyma R.
SEVERNAYA ZEMLYA
LARTEV SEA
TAIMYR TROUGH
NORDVIK
ZLIA
POPIGAI
TIKSI
KYUSYUR
Khatanga
ANABARA BASIN
LENA TROUGH
Indigirka R.
Yakutya - Kolyma Line
MAGADAN
V. OZERNAYA
VOYAMPOLSK
UST KAMCHATSK
TIGIL
KAMCHATKA SEA
PETROPAVLORSK
NORILSK
IGARKA
ARCTIC CIRCLE
Lena River
UNGUSKA
UST MAJA
KANGALASSY
Vilyui R.
VILYUISK
YAKUTSK
VILYUI DEPRESSION
Sinaya R.
ALDAN MASSIF
Aldan R.
TUNGUSIAN BASIN
North Siberian Line
KEMPENDZYAY
OLEKMINSK
KURA DEPRESSION
Olekma R.
SEA OF OKHOTSK
SAKHALIN
NIKOLAEVSK
KURILE ISLANDS
Angara R.
Lena R.
Trans-Siberian Line
KANSK
TAISHET
OSETROVO
KOMSOMOLSK
SOV. GAVAN
IZHNEUDINSK
CHEREMKHOVO
BASIN
KACHUG
BARGUZIN
Yuzhno-Sib. Line
KHABAROVSK
IRKUTSK
OIMUR
CHITA
BROBIDZHAN
ULAN UDE
MANCHURIA
TANKHOI
KYAKHTA
BIMAN
SPASSK
ULAN BATOR
VOROSHILOV
VLADIVOSTOK
SEA OF JAPAN
JAPAN
MONGOLIA

emy of Sciences; The Northeastern Permafrost Institute, of the same academy; The Yakutsk Geological Administration, at Yakutsk; The State Administration of the Far Northern Projects, with its locale at Magadan; the Far Eastern Geological Directorate, at Khabarovsk; the Chita Geological Administration, at Chita; the East Siberian Oil and Gas Geological Trust, at Irkutsk; the Irkutsk Geological Administration (endowed with its own geological institute), at Irkutsk; the Siberian Scientific Geological Research Center, at Tomsk; the Geological and Geophysical Institute, at Novosibirsk (which is one of the 13 institutes established recently at the new Novosobirsk scientific center).

In order to gauge correctly the intensity of the geological activity carried out in Siberia, it will suffice to mention that most of these entities and institutes came into being during the past four to five years. Further geological institutes are planned in the near future, at Krasnoyarsk, Ulan Ude, Yakutsk, and Magadan. Following the decentralization reform of last July, these bodies have acquired a large degree of autonomy, and their activities are no longer interfered with by the Moscow bureaucracy.

It probably will take several more years before the structures found during this intense geological search will be prepared for drilling and, eventually, yield petroleum. With the exception of the entire area eastwards of the Lena and Aldan Rivers—which is tagged as hopeless—most of the vast Siberian platform is a sedimentary basin, and has a good accumulation of properties. The platform consists of the western and eastern Siberias, divided by the folding structure of the Yenisei ridge. It rests on a crystalline foundation over which are mostly Cambrian deposits (which, at places, reach 16,000 ft in thickness), and only sporadically by Silurian and Devonian deposits.

Although still largely unknown, western Siberia seems to be a potential basin, judging from the favorable structures discovered on its borderlands. During the past four years, very rich gas deposits have been discovered at Berezovo, on the lower Ob; Tyumen, on the Tobol River; and at Kolpashevo, in the Tomsk region. Earlier still, oil was struck at Barzas, north of Kamerovo. This latter area is known to have many horizons in Permian and Devonian of very good collecting capabilities. This previous information—and, undoubtedly, new data collected from recent exploratory work on western Siberia (not yet disclosed)—have prompted Soviet officials to state emphatically that the whole West Basin should be considered as oil-bearing. There is, however, no information as to oil production in this area up to the present time.

Eastern Siberia is surrounded by folding structures which encircle several quality basins. The Lena-Taimyr, for instance, is an oil-bearing basin with extensive salt domes. Three of these have been drilled so far: Nordvik, Kozlevnikov, and Ilia—all located along the Khatanga Bay. They are, at present, the main producers of the entire Arctic coast.

In the Vilyui depression—which is, apparently, Siberia's most promising basin—small industrial production is in progress at the following points, starting from east to west: Ust Maja Kangalassy, Amga, on the structure between the Sinyaya and Lena Rivers, between the latter and Tuolba River, as well as at Oleminsk.

In the Tunguska basin, west of Yenisei, there are numerous favorable oil structures. Outstanding among them are Ust Port, Igarka, and Sukhaya Tunguska. This and the aforesaid basins lie in the arctic area and in the permafrost and tundra zone where conditions for drilling are virtually forbidding. The development of these structures will depend, first of all, on the ability of Soviet scientists to solve unusually difficult technical problems raised by the local climate.

By contrast, the basins located on the southern fringes of the Siberian platform are far easier to explore and develop; yet—also by contrast—their quality is far more modest. On the western shore of Lake Baikal, small oil fields have been developed at Barguzin, Oimur, Tankhoi, and Selengansk—though their commercial value remains an open question.

Greater hopes for the future supply with oil of eastern Siberia are pinned on the enormous mass of Tertiary deposits on the Kamchatka peninsula. On the eastern shore, Bogachevka, Ust, Kamchatka, and Kronotskaya are producing structures. On the western shore, producing fields are located at Voyampolsk, Totchilin, Kovatchin, and Khromov—all discovered prior to the last war. The crude oil extracted on Kamchatka is sent for processing to the plants on the Khabarovsk coast. Kamchatka output is a well guarded Soviet secret; its own estimates would put it at upwards of 2,000 b/d.

Should the Soviet government decide to radically change the present peripheral supply pattern of the central Asian republics, the prospects for quick development of local oil resources are far more favorable than for Siberia. Outstanding among central Asia's basins is the Cis-Caspian depression, which includes the Emba salt domes. The latter extends over almost 150,000 square miles, and has a great number of salt domes. Emba is Russia's second largest oil basin after the Ural-Volga region. The Aktyubinsk salt-dome region, located north of Emba, has also a large number of promising structures. The development of both regions is, however, halted by the difficult desert conditions, the lack of industrial water and, particularly, by the high drilling costs caused by the local geological conditions.

With the exception of four small fields located in the inland (Dzhusa, Tabantal, Shubar-Kuduk, and Dzhaksy), all commercial fields are concentrated on the northern Caspian coast. Most important among them is Koshangyl, discovered in 1937, which yields an asphalt-type crude of 33 API gravity and a 76 octane number. The second producer is Dossor, which is Embia's oldest field (discovered in 1911). It yields a crude of 30.4 API gravity and a 72 octane number, from which is processed the best Soviet lubricating oil. Further producing oil fields are at Novobogatinsk, Makat, Kulsary, Komsomolsky, Baychunas, Koshar, Karaton, Sagiz, and Munaili. Processing is done in the three small coastal plants (at Novobogatinsk, Gurev, and Iskininski) and at the Orsk refinery, the enlarging and modernization of which has just been completed. A 512-mile pipeline, with three coastal branchings, runs from Gurev to Orsk.

The main producers in the western Turkmenian basin is Cheleken Island (developed as far back as 1910) and Nepit Dagh. But far richer deposits lie south of Nepit Dagh, near the Iran frontier, as well as on the southern fringes of the Ust Urt desert where exploration work has been conducted since last year. The development of these reserves will probably be delayed for awhile by the lack of water and the difficult desert conditions.

Industrial oil deposits have been established on the eastern and southeastern rims of the Turkmeno-Tadzhikian trough, particularly in the Khiva and Bukhara depressions. Their development had been long fettered by the wilderness of these regions and the lack of transportation. The completion of the Chardzhou-Tashaus railroad in July 1955, and the impending opening of the Kara Kum Canal, are opening new vistas for these desert areas. Exploration along the Amu Daria has been intensified. A new rich oil field was discovered in 1956, south of Bukhara. A year earlier, a rich gas deposit was struck in the same region, at Jarkak. This discovery prompted the laying of a gas pipeline 500 miles long from Jarkak over Bukhara and Samarkand to Tashkent. By comparison, the Tadzhikian structures are far better developed, owing chiefly to the more favorable geographical conditions of the area. Their main producers are Kurgan Tyube, Kulyab, Uch Kzyl, and Termez.

It was 55 years ago that the first industrial oil was extracted from the Fergana Valley. Although prior to the last war numerous structures were discovered in this depression, and additional ones since 1953, less than a score have been developed to date. The production rate in Fergana will be kept commensurate with the local requirements; hence, no great upsurge in output may be predicted for the near future. The main producers are the Changyrtash field, discovered in 1940, and Khodzhiabad. Fergana crude shows an API gravity of between 32.5 and 27.2; an octane number of 50 to 65; has a paraffin base; and a rather high sulfur content (from 0.3% to 2.7%). New gas fields recently have been tapped, and a gas pipeline is under construction to service the adjacent industrial centers. The capacities of the four refineries (at Tashkent, Malnkovo, Leninsk, and Fergana) are proportionate to the crude production extracted locally. A new plant is under construction at Kanibadam. END

Electronic controls selected for Esso Netherlands plant

New Esso refinery at Rotterdam will produce maximum quantities of fuel oils and minimum quantities of motor fuels

REFINING capacity of The Netherlands will be increased by nearly a fourth in the spring of 1960 when Esso Nederland NV completes the 95,000 b/d plant on which construction now has begun. Other operating plants in the country are the 300,000 b/d Shell and 56,000 b/d Caltex plants at Rotterdam (Pernis).

Esso Nederland NV has so far obtained its products largely from the Esso refinery in Antwerp. The Antwerp refinery was completed in 1953, and was originally intended for supplying the requirements of the Esso marketing companies in the Benelux countries. However, the extremely rapid growth in European oil consumption has necessitated an earlier increase in the refinery capacity than was anticipated. Therefore, a year and a half ago, Esso Nederland decided to build a new large refinery in the Botlek area.

Site of the new plant is situated west of the Old Meuse, just beyond the Botlek bridge. Two arms of the third petroleum harbor—which has not been entirely completed yet—indicate its eastern and northern bound. The Botlek road will form its southern and western borders. This is the important road by which products will be brought to and taken from the new industrial district. The refinery site covers 172 hectares. Its longer side is about 1,900 meters and its shorter side about 1,250 meters in length; the refinery itself will have a waterfront on the third petroleum harbor of 1,600 meters and the tank farm 637 meters waterfront.

The new Esso project is based on confidence in the constant increase in power requirements, both in The Netherlands and in all western Europe. In the past 10 years, the demand for power in The Netherlands has been annually increased by 11%. On an average and notwithstanding the plans of the government to build nuclear power stations, the company thinks that in the coming decades this growing demand for power will, to a large extent, have to be satisfied by the oil industry. That is why the present economic situation did cause a deferment. On the contrary, the refinery project will require the services of many Dutch industries and of about 2,000 Dutch laborers during the construction period.

Esso Research and Engineering Co.—which opened an office in The Hague last October—designed the plant. The principal contractor is Badger-Comprimo Ltd., of The Hague. This firm will supervise the various subcontractors. The Rotterdam civil engineering consultants J. P. van Bruggen, G. Drexhage, J. J. Sterkenburg, and A. Bodon will act as architects and advisers for the building of the administrative office and the workshops.

About one-fifth of the oil to be processed will be derived from Dutch soil. Netherlands Petroleum Co. (NAM), half owned by Standard Oil Co. (N.J.), will supply this oil. The rest of the crude to be processed will be imported. Present tonnage (74,000 dwt) of Esso Tankvaart Maatschappij will be extended by three supertankers which are being built in Dutch yards and which will total 117,000 dwt.

The new Esso plant has been designed for maximum production of fuel oil and middle distillates and high-octane motor fuel. Motor-fuel volume will be minimized in line with current trends in market demand.

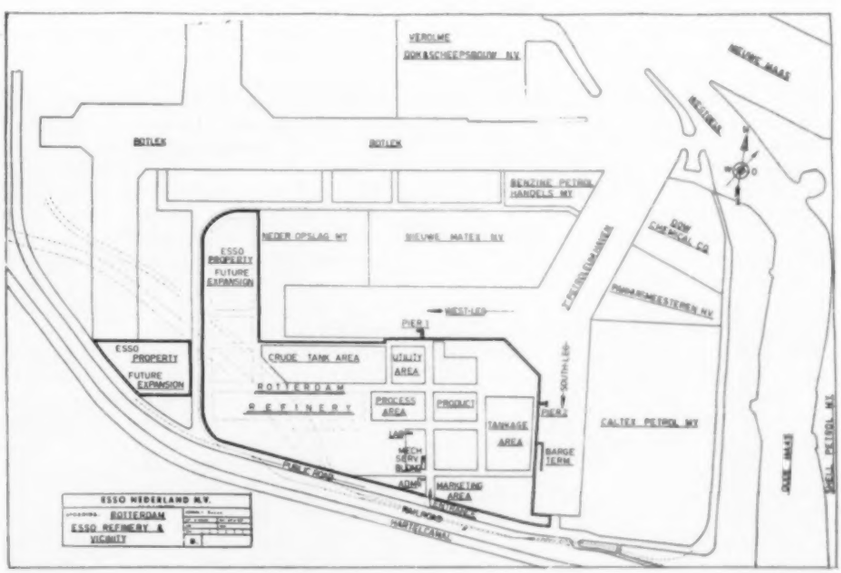
A number of innovations in European refining are to be incorporated in the new plant. Airfins are to be employed for cooling instead of water, to avoid possible pollution of effluent water.

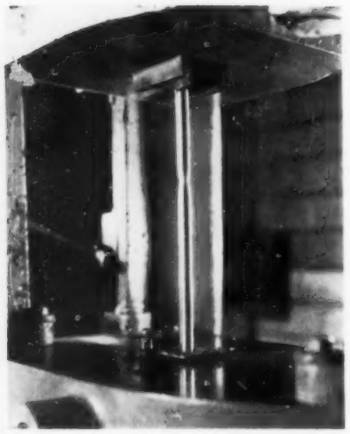
Floating-roof tanks are to be used for storage of volatile products. Some of the largest tanks will have a capacity of 150,000 bbl. Gauging will be done electronically with remote reading.

Electronic controls also have been selected for process control throughout the plant; and, in announcing this decision, Eng. J. A. Beukers, general manager of Esso Nederland, NV, said that they feel this equipment offers more possibilities for a modern plant.

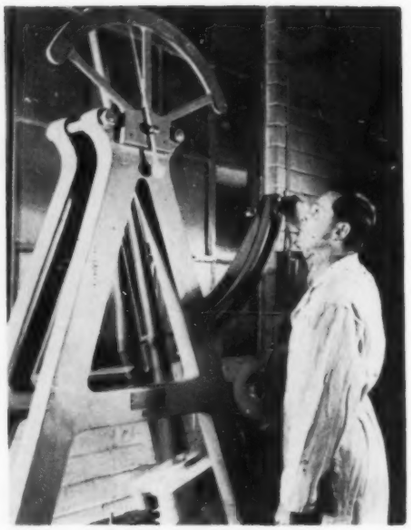
"Our decision," he said, "in favor of the use of electronic instruments in the Esso refinery in Rotterdam was not influenced by considerations of cost, to be sure. On

(Continued on page 70)





Left:
Tensile test on rod sample: Sample is nearing rupture on ultimate stress (note necking down). Per cent of reduction area, a function of material ductility, is computed from the difference in cross-sectional area of the neck and original cross-section area. Per cent of elongation—also a function of material ductility—is arrived at by measuring longitudinal deformation in a given unit of length before and after pulling (photo courtesy Axelson Manufacturing Co. Division of U.S. Industries Inc.).



Technician makes Izod impact test, a measure of the impact toughness. Swinging pendulum records required foot-pounds to break off unsupported end of a specimen of given diameter (photo courtesy Axelson Manufacturing Co. Division of U.S. Industries Inc.).

Progress in the development of sucker rods for oil-well pumping — PART II†

by Lester C. Uren*

Design of sucker-rod strings: Maximum efficiency in performance of a column of sucker rods in a pumping well can be assured only by careful analysis of the conditions imposed and proper selection of the size and quality of rods to be used. Critical factors include the depth from which the well fluid must be lifted, the volume of fluid to be lifted per day and size of pump necessary, the length of stroke of the rods and timing of the stroke. Consideration of these factors, together with the maximum possible stress which the rod metal can safely sustain, will enable one to determine the size of pump and diameter of rods which may be most efficiently employed.

Sucker-rod stresses: When in service in the well, sucker rods are always in tension. Both static and dynamic stresses are imposed on the rods in the routine operation of deep-well plunger pumps. The principal static load is that of the weight of the rods, which is always operative. Another important static load is that imposed by the weight of fluid in the tubing above the pump plunger. This imposes stress in the rods only on the upstroke of the pump plunger—the weight of fluid above the plunger being transferred to the tubing on the downstroke. In addition to these static loads, dynamic stresses in the rods are imposed by application of the force necessary to move the pump plunger in its working barrel and accelerate the mass of the sucker-rod string and the column of fluid in the tubing from zero to its maximum rate of upward travel with each upward stroke of the pump. The dynamic loads are not operative on the downstroke. Thus, with each up-and-down stroke of the pump plunger, the sucker rods are subjected to a varying tensile stress of considerable range. The stress is much greater on the upstroke of the pump plunger than on the downstroke. The combined static and dynamic loads may develop stresses of 30,000 psi or more in the sucker rods when operating large-diameter pumps in deep wells at high rates of plunger travel.

Such a stress maybe in excess of the yield point of the steel. For ordinary steels having a tensile strength of 90,000 psi and a yield point of 60,000 psi, the safe working load may not exceed 13,170 psi and 17,200 psi for ⅞-in. and 1-in. rods, respectively. Increasing the diameter of the rods does not greatly increase the load-carrying capacity, because a large part of the load is due to the weight of the rods—and this increases directly with the square of the rod diameter. Greater load capacity, however, is secured by using alloy steel of higher tensile strength and yield point. Important progress has been made in this direction by use of certain alloy steels which, with careful heat treatment, develop tensile strengths as high as 135,000 psi and yield points of 115,000 psi. Heat treatment of certain high-carbon-manganese steels develops yield points as high as 75,000 psi.

Theoretically, the elastic limit of steel determines the maximum working stress to which sucker rods may safely be subjected in pump operation; but, practically, it is found that rods may fail in service when stresses considerably below the elastic limit are repeatedly applied. This is due to a property of metals termed "fatigue" which results in rupture of the metal along component crystal planes. Most sucker-rod failures in well-pumping service are apparently fatigue failures. The fatigue resistance of steel is a highly variable property which is adversely affected by corrosive influences usually present in oil wells. Though rod metals having a yield point in excess of 100,000 psi may be selected, reasonable security against corrosion-fatigue failure often affords a safe working stress of only a quarter or a third of this. Physical tests indicate that the endurance limit

†This is the second in a series by Dr. Uren. Part I appeared in World Petroleum, August 1958.

* Emeritus Professor of Petroleum Engineering, University of California, Berkeley, Calif.

of steels used in sucker-rod manufacture may range from 45,000 psi to 64,000 psi in air; from 25,000 psi to 36,000 psi in salt water; and from 23,000 psi to 25,000 psi in hydrogen sulfide. With rod sizes commonly used in well-pumping service (⅝-in. to 1-in.), this permits a maximum peak load of only 8,000 lb to 24,800 lb.

When one considers that sucker-rod loads vary by many thousands of pounds in a few seconds with each pumping cycle, and that the rods may be subjected to 25,000 alternations of stress daily, it is not surprising that most sucker-rod failures are a result of metal fatigue. Examination of the parted ends of rods broken in service will usually display the coarse crystalline appearance characteristic of fatigue failures, without the "necking down" or reduction in cross-section typical of rods subjected to strain in excess of the elastic limit. The point of fracture will often be determined by some local irregularity in texture of the metal—resulting, perhaps, from forging stresses, heat treatment, or segregation of certain constituents of the steel. Sharp bends in the rods, nicks, or even minor scratches on their surfaces may become centers of abnormal strain in the metal—greatly reducing its resistance to fatigue. Areas where corrosion of the metal has been active are particularly susceptible to fatigue failures.

Sucker rods usually part in service as a result of joint failure—generally resulting from pin breakage at the root of the first full thread where fatigue stress is often concentrated. Due to the great weight of the column of rods, maximum stresses occur in the joints near the surface. The break is always at right angles to the axis of the pin; it is smooth where the break starts, but rough and ragged 180 deg from the start where the final rupture occurs. It is believed that failures of this type can only occur when the joint faces separate under excessive loads, and that they may be minimized by secure makeup of the joint—developing greater tensional stress in the pin than that induced by the working load.

Ductility is also an important property in selection of sucker-rod steel, for a brittle steel is less able to resist the rapid changes in stress imposed. High-carbon steels develop greater tensile strengths and higher yield points than low-carbon steels; but, unless alloyed with other metals or carefully heat-treated, they are unsatisfactory for use in sucker-rod manufacture because of their characteristic brittleness. Steel of high strength and yet without loss of ductility may be produced by addition of 1.2% to 1.5% of manganese, with suitable heat treatment of each rod to normalize the metal.

Elasticity of the steel must be preserved in sucker-rod manufacture, for on this property depends ability to maintain a proper plunger stroke in deep-well pumping. The long column of rods stretches as stress is imposed; and, if it were not for the elasticity of the rod metal, much of the stroke provided by the beam-pumping unit at the surface would be lost at the pump

Furnace for heating ends of rods prior to forging (photo courtesy Oil Well Supply Division, U.S. Steel Corp.)

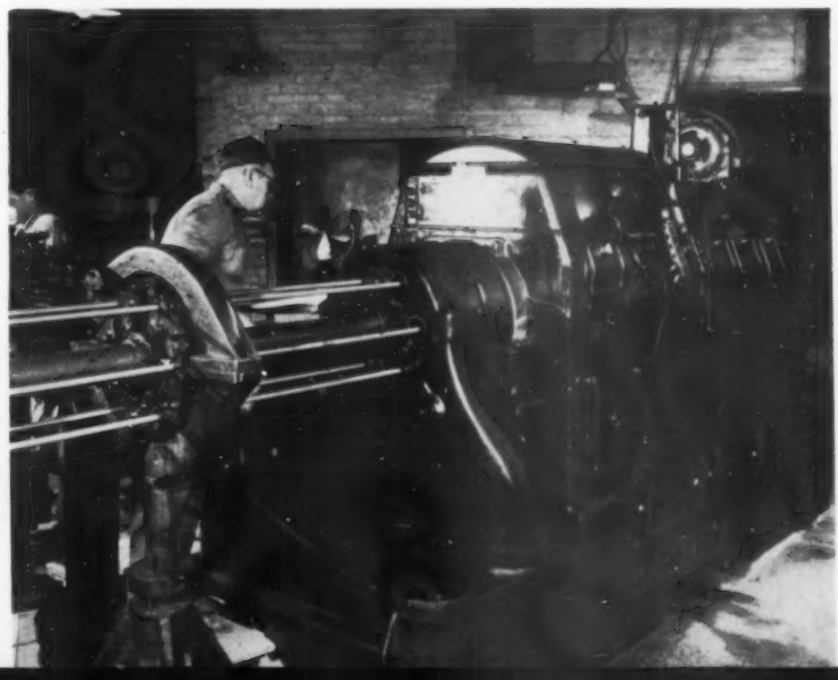
TABLE II

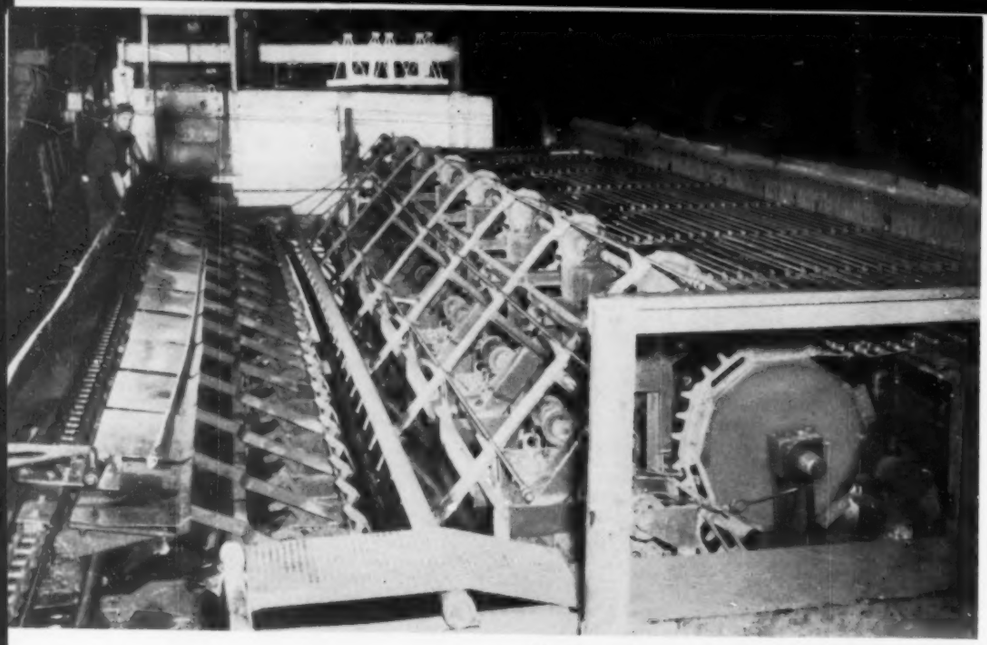
TAPERER SUCKER ROD STRINGS

PLUNGER DIAM.	¾" x ⅝"		⅞" x ¾"		⅞" x ¾" x ⅝"			1" x ⅞"		1" x ⅞" x ¾"		
	%	¾"	%	⅞"	%	%	%	%	1"	%	%	%
3/4"		27.0		23.8								
15/16"		28.9		24.6								
1"		29.6		25.0	19.3	23.0	57.7	22.7	16.7	19.0	64.3	
1-1/16"		30.5		25.5	20.3	23.4	56.3	23.1	17.2	19.5	63.3	
1-1/4"		33.2		27.3	22.6	26.1	51.3	24.3	18.7	21.2	60.1	
1-1/2"		37.4		29.6	26.5	30.2	43.3	26.2	21.1	23.9	55.0	
1-3/4"		42.3		32.9	30.6	35.2	34.2	28.4	23.9	27.0	49.1	
2"		48.2		36.5	35.7	41.0	23.3	30.9	27.1	30.7	42.2	
2-1/4"		54.4		40.6	42.0	47.0	11.0	33.8	30.9	34.8	34.3	
2-7/16"		59.8		44.0				36.2				
2-1/2"		63.0		45.0				37.0	35.0	39.5	25.5	
2-3/4"		69.7		50.2				40.6	39.5	44.6	15.9	
3-3/4"				75.4				58.2	44.5	50.2	5.3	
4"								58.5				

(Courtesy of The S. M. Jones Co., Division of Buffalo-Eclipse Corp.)

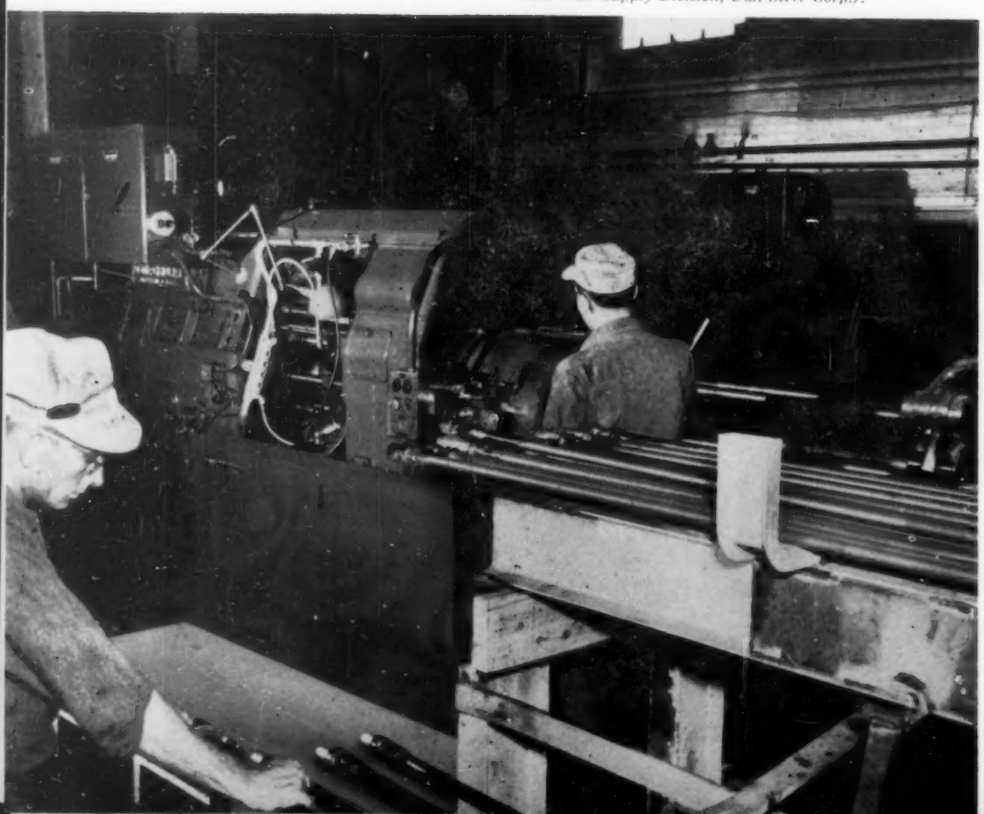
Automatic threading machine (photo courtesy The S. M. Jones Co. Division of Buffalo-Eclipse Corp.)





Liquid-quenching sucker rods to develop optimum strength (photo courtesy Oil Well Supply Division, U.S. Steel Corp.).

Machine for cutting threads on sucker rods (photo courtesy Oil Well Supply Division, U.S. Steel Corp.).



plunger. A slow motion of the rods may thus result in little or no displacement of oil by the pump plunger. But by adjusting the timing of the stroke and length of stroke at the walking beam, the elasticity of the steel may permit of sufficient "reach" and "lift" in the column of rods to preserve the full length of beam stroke at the pump plunger, or even to develop a certain amount of over-travel.

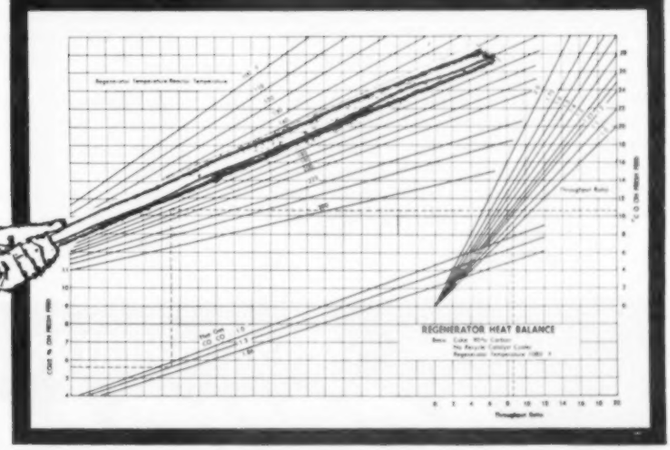
Tapered Sucker-Rod Strings: Because the dead load on a column of sucker rods is greatest near the surface and diminishes with depth below the surface, it follows that economy may be realized and yet security against excessive stress may be preserved by use of "tapered" sucker-rod strings. In a tapered string of rods, two or more different sizes of rods are used—with the larger-diameter rods near the surface on the upper end of the string, and progressively smaller-diameter rods used as depth increases, with the smallest diameter rods on the lower end of the string. It is, of course, necessary to use only the readily available standard sizes of rods, so that a truly tapered string is not feasible. Instead, we use a calculated percentage of the overall length of the string of each of two to four standard sizes—the percentage of each size being so determined that a safe maximum unit stress in the upper end of each rod section is not exceeded. For shallow wells, the sucker-rod string may conveniently be made of two sizes of rods; for deep wells, three or more sizes will ordinarily be used. For example, a 3-component string made up of 1-in., ⅞-in., and ¾-in. rods, for use with a 2-in. plunger, would have 27.1% of the total length of 1-in. rods on the upper end, 30.7% of ⅞-in. rods below this, and 42.2% of ¾-in. rods on the lower end of the string. This string of rods would meet all operating requirements as well as if it were composed entirely of 1-in. rods and yet would permit of a considerable saving in rod and power costs. Table II suggests percentages of different sizes of rods in two- and three-size combinations which will give proper stress distribution and maximum economy in the design of tapered strings.

Hollow Sucker Rods: Tubular forms of sucker rods may be used in special cases instead of solid rods. The tubes have center-bored pin connections at each end, and are coupled by API rod couplings. They may advantageously be used in wells presenting paraffin or sand difficulties and in dually-completed wells. Heated oil or sand-free oil may be circulated down from the surface through the hollow rods to join the incoming sand-laden or waxy oil produced by the well. Greater buoyancy of hollow rods in the well fluid also helps to reduce rod-string loads. The API has not as yet standardized hollow rods.

Dynamometer Tests at the Well Head to Determine Sucker-Rod Stresses: While it is possible to calculate sucker-rod stresses by application of available engineering certainties—primarily because of the diffi-

(*Continued on page 58*)

BORN BUILDS BETTER HEATERS



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Progress in the Development of Sucker Rods

(Continued from page 56

culty of determining all of the factors involved. A more practical approach involves actual measurement of the stresses imposed with the aid of a specially designed dynamometer. This device is inserted between the polished-rod grip and the beam hanger which suspends the column of sucker rods from the walking-beam mechanism. The dynamometer is responsive to changes in stress in the polished rod, and graphically records the stresses imposed by operation of the pump at all times during an up-and-down stroke of the rods. The dynamometer record shows the resultant of all forces operative at each instant in the pumping cycle. Such a record may afford not only a direct measure of variations in rod stress, but may also provide a basis for estimates of the performance of the pump at the lower end of the rod column—perhaps suggesting adjustments which can be made in the length and timing of beam stroke and balancing of loads which will assure a minimum range of stress and maximum efficiency in power application and pump efficiency.

Balancing Loads in a Well-Pumping Installation: Much may be accomplished in reducing rod vibration and in obtaining smooth operation of rod-actuated pumping installation by proper balancing of the walking beam and power-transmission mechanism. Most pumping units and band-wheel walking-beam power-application mechanizations provide a means of balancing the loads as between the up-and-down strokes of the rods—thus achieving an approximately uniform loading throughout the pumping cycle. A recording tachometer, indicating variations in prime-mover speed in different parts of the pumping cycle, will assist in adjustment of the counterbalances to obtain a uniform rate of crank rotation.

Use of Corrosion Inhibitors to Prolong Life of Sucker Rods: In wells where corrosive conditions exist, down-the-hole treatment of the well fluids with a suitable corrosion inhibitor will often materially increase the useful life of sucker rods by reducing their vulnerability to corrosion fatigue. Corrosion in subsurface well equipment may result from electrolytic, galvanic, or chemical activity, and the type of protection provided will depend upon the results of a study of well conditions and corrosive influences. Corrosion often results from the presence of hydrogen sulfide in the well fluids, or from acid conditions resulting from the presence of carbonic acid or corrosive ground waters.

A variety of different chemical inhibitors —some organic, others inorganic in character—are used in reducing corrosive effects. Soluble sodium chromate, sodium phosphate, and sodium nitrate are widely used inorganic inhibitors. For acid conditions, various salts of arsenic and antimony are useful. Formaldehyde and calcium and sodium cyanimides are among the many organic inhibitors which have been used.

Selection of Appropriate Size of Pump Plunger to Avoid Overstressing of Sucker Rods: The weight of fluid in the tubing which must be lifted with each upward stroke of the sucker rods will vary directly with the difference between the square of the diameter of the pump plunger and the square of the diameter of the sucker rods. Thus, with a given diameter of sucker rods, we may reduce the live load and unit stress on the rods by reducing the diameter of the pump plunger. In a deep well, excessive sucker-rod stress may compel use of a smaller-diameter plunger and, perhaps, a rate of production less than that of which the well is capable. The choice of a size of pump plunger is also involved with the choice of a practical rate of plunger travel for the conditions presented, and this is determined by the length and timing of the plunger stroke. For deep-well service, stress limitations often dictate a plunger diameter of 1¾ in. or less.

Adjustment of Time and Length of Stroke of Rods to Secure Maximum Pump Efficiency and Minimum Rod Stress: For equal rates of plunger travel, a long, slow plunger stroke is likely to develop less stress in the sucker rods than a larger number of short, rapid strokes. Thus, twelve 10-ft plunger strokes per minute will lift as much oil as forty 3-ft strokes—requiring fewer stress reversals and, hence, less tendency to rod failure by metal fatigue. Some long-stroke

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Proper timing of the plunger stroke is equally important. In a long string of rods, elasticity of the rod metal and improper timing may permit the upper end of the column of rods to start its upstroke before the pump plunger completes its downstroke —resulting in excessive vibration and shock stresses in the rods. Proper timing of the stroke will avoid this, and produce a longer plunger stroke with improved pump efficiency. Use of a sucker-rod dynamometer and a recording tachometer will assist in these adjustments.

Limiting Depth in Rod-Pumping Operations: As wells become deeper, it becomes increasingly difficult to avoid excessive rod stresses and maintain efficient power application and plunger displacement. Some authorities believe the maximum depth possible for efficient operation of rod-actuated pumps is about 12,000 ft. During recent years, many wells have been drilled to depths greater than this; and it seems probable that, when their fluid levels fall to depths in excess of the limiting depth for efficient sucker-rod pumping, other methods of lifting must be adopted. Some rodless types of oil-well pumps, capable of operation at greater depths, have been developed and may be competitive with rod-actuated plunger pumps even at shallow or moderate depths. The Kobe hydraulic pumping system, for example, is highly efficient, and may be used in wells of any depth. Pneumatic methods of lifting oil are also widely used, and are adaptable to wells of any depth. Large-capacity electrically operated centrifugal pumps, such as the Reda pump, have also been successfully used in pumping from depths as great as 6,000 ft, and could be adapted to wells of greater depth. While these rodless methods of lifting oil are available, most producers still show a decided preference for the simple, rugged type of plunger pump actuated by sucker rods which has been the most widely used method of pumping oil since the early days of the oil-producing industry.

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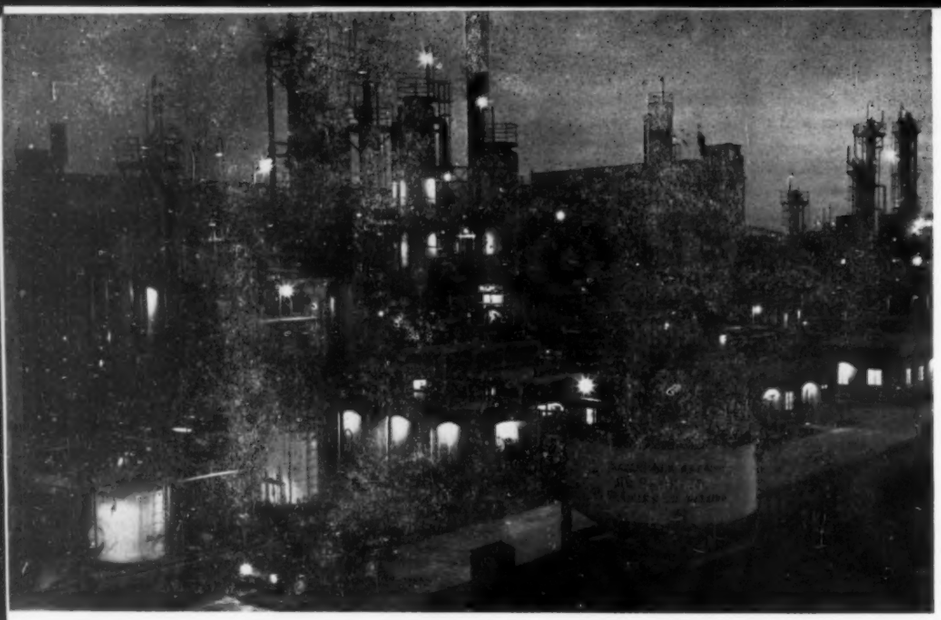


Wyandotte Chemical Corp.'s plant for production of ethylene and propylene glycol by the chlorohydrination route (photo courtesy Wyandotte Chemicals Corp.)

Petrochemical horizons for propylene

Part III: *Acrolein, glycerin, and propylene glycol*

by Peter W. Sherwood*

III—Oxidation to Acrolein

Like hydrogen peroxide, acrolein's future growth will be significantly influenced by Shell Chemical Co.'s new synthetic glycerin process, in which it serves as intermediate. Until this new method of glycerin production becomes a commercial reality, acrolein's market consists of a collection of minor outlets.

Of commercial importance is the use of acrolein as intermediate in the production of methionine, a poultry-feed additive. Other chemical applications for acrolein take advantage of this aldehyde's high reactivity. Thus, it serves in the manufacture of acrolein dimer, hexanetriol, 1,2,6 trimethylene glycol, and glutaraldehyde. Potential uses of interest for acrolein and its derivatives include the production of polyurethanes, polyester resins, amino acids, as well as of various textile chemicals and plasticizers.

There are today two commercial producers of acrolein in the United States. One of these (Carbide and Carbon Chemicals Co.) employs the classical manufacturing process which involves the condensation of formaldehyde with acetaldehyde. Details of this method have been reported by the writer elsewhere.[1]

* Chemical Engineer, White Plains, N.Y.

In 1957, Shell Chemical Co. began operation of its acrolein production unit at Norco, La. Raw material at this installation is propylene and the method, therefore, calls for more detailed discussion in this place.

Basis of Shell's new acrolein synthesis is the partial oxidation of propylene:

$$CH_2{=}CH{-}CH_3 + O_2 \longrightarrow \underset{\text{ACROLEIN}}{CH_2{=}CH{-}CHO} + H_2O \quad \cdots\cdots (8)$$

The reaction is carried out in the vapor phase. Several catalysts are capable of directing the formation of acrolein in attractive yield—among them cupric oxide on silica gel, supported selenides of silver, and supported cuprous oxide. It is probable that commercial propylene oxidation is based on the last-named type of catalyst.

In using suprous oxide, the choice of catalyst support is critical. According to Hearne[2], propylene oxidation over cuprous oxide on silicon carbide can attain an acrolein yield of 86%, while a 27% efficiency is limiting when pumice serves as carrier. Metal content of supported cuprous-oxide catalyst in this service is about 1%.

The oxidation reaction over cuprous oxide can be carried out effectively at widely varying conditions. Hearne[2] reports the following preferred operating ranges:

Oxygen concentration in reaction mixture prior to contact with the catalyst, % by volume	4 to 8
Mole ratio, propylene to oxygen	4:1 to 10:1
Balance of reaction mixture	Steam, or steam plus inert gases such as N_2, CO_2, propene, etc.
Apparent contact time, seconds	0.1 to 2
Temperature, C	250 to 450
Pressure, atmospheres	1 to 10

Means must be provided to remove the highly exothermic heat of reaction (approximately 95 K-cal per gram-mole). This can be done effectively by the use of a shell-and-tube reactor in which the catalyst is mounted inside the tubes.

The production of acrolein is accompanied by the formation of carbon dioxide and saturated aldehydes. In addition, lesser amounts of carbon monoxide and carboxylic acids, as well as some minor quantities of noncarbonylic compounds and polymers, are found in the product. To obtain high selectivity of acrolein formation, it is necessary to operate at low propylene conversion per pass. Available data indicate

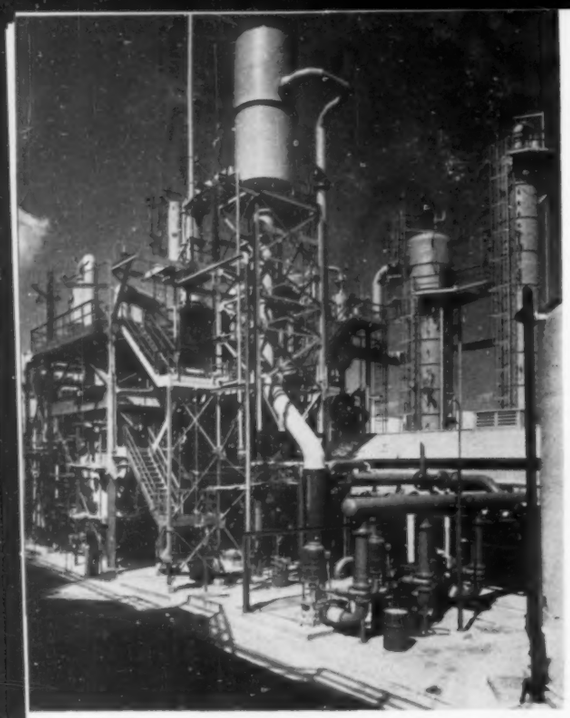
"Productivity is the end result of four factors working together effectively: labor, management, capital, and technology. No one or two can produce alone—all four are needed. And a reasonable balance among all four must be achieved constantly. To maintain this balance in our complex world today requires more knowledge, more understanding, more creativeness and more objective thinking on the part of more people. Education should lead towards this result, and the broadly trained scientific college graduate is certainly one of the key figures in the picture."

M. J. Rathbone, President, Standard Oil Company (New Jersey)

Esso

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES



Evaporators and desalting equipment at Deer Park glycerol plant of Shell Chemical Co. (photo courtesy Shell Chemical).

a preferred pre-pass conversion of 10% to 20% of the propylene.

To avoid degradation reactions after the process stream leaves the oxidizers, the effluent must be cooled quickly. This can be accomplished by feeding the gas to the bottom of a quench tower. Water is fed to the column's top at 20 C to 50 C, and the bottom's temperature is maintained at 80 C to 100 C.

Performance in the partial oxidation of propylene has been illustrated by Hearne[2], who used a catalyst containing 1.43% by weight of copper in the form of cuprous oxide, supported on porous silicon carbide. The feed gas was a mixture of 7.8% by volume of oxygen, 27.6% propylene, 35.3% steam, and 29.3% nitrogen. Conversion was carried out at 348 C, allowing a contact time of 0.8 sec. At these conditions, 24% of the oxygen reacted (corresponding to a propylene conversion of 6% to 7%). Yield of crude acrolein was approximately 86% on reacted propylene.

Fresh cuprous-oxide catalyst tends to show pronounced less activity after a few hours onstream. According to Detling[3], a high level of activity and selectivity can be restored by continuing the flow of propylene at normal reaction temperature but, in the absence of oxygen, for a period of about 15 min.

Beneficial effect on acrolein yield has been reported for the use of small amounts of organic chlorides, which are introduced with the feed gas and serve as inhibitors of the complete combustion of hydrocarbons to carbon dioxide and water. It is noteworthy that chlorides also are effective combustion inhibitors in the partial oxidation of ethylene to ethylene oxide, but that their presence—unless kept at a very low level—will poison the silver catalyst employed in that reaction. The effect of chlorides on cuprous-oxide catalyst in propylene oxidation has not been reported.

Acrolein Recovery: The feed to the oxidation reactors contains only 25% to 30% propylene, and only some 10% of this olefin is converted per pass. The converter make, therefore, is quite dilute in acrolein; it contains only some 2% to 3% of the desired product.

Either liquid propylene or water may be used as scrubbing medium to remove acrolein from the converter gas. In either event, a high ratio of solvent to product is required. At 99.9% recovery, propylene scrubbing will yield a sorbate liquor containing 2.6% by weight of acrolein, while water scrubbed at 260 psia and 20 C will lead to a bottoms product with 1.7% by weight of acrolein content. It is evident, therefore, that the recovery step introduces a major cost element in the production of acrolein from propylene. Water scrubbing appears to be the preferred course for initial product removal from the oxidizer gas.

The aqueous solution obtained in the absorption stage contains a complex mixture of organic compounds. The first step in their recovery is a stripping operation in which acrolein, together with associated light boilers, is taken overhead. In this topping step, there is a tendency to formation of polymers—which is harmful to yield and causes obstruction in the stripping tower. This difficulty can reportedly be overcome by deoxygenating the solution prior to the steam distillation. This oxygen removal is accomplished by adjusting the liquor's pH between 6 and 7 and heating it to its boiling point for about 3 min.

Stripping of the deoxygenated solution is carried out in the presence of a polymerization inhibitor, such as hydroquinone. The crude product which is taken overhead at this stage contains some 80% to 90% by weight of acrolein, 3% to 10% acetaldehyde, and 2.4% to 6.0% water. In addition, it contains some propionaldehyde, acetone, plus minor contaminants.

Further upgrading of this mixture is rendered difficult by the occurrence of a water-acrolein azeotrope (containing 2.7% by weight of water at atmospheric pressure) and by the low relative volatilities of propionaldehyde and acetone in relation to acrolein.

A split between propionaldehyde, acetone, and acrolein may be made effectively by extractive distillation—using water as solvent, and operating at a bottoms temperature below 20 C. To permit distillation at these conditions, high vacuum (approximately 50 mm Hg) is called for. The overhead from such an extractive distillation step is acrolein in 99.4%, by weight, purity. Water is present in 0.4% concentration, corresponding to the azeotropic composition at 50 mm Hg. Most of the remaining 0.2% is propionaldehyde. This, too, can be almost completely eliminated by 2-stage extractive distillation at different pressures. Acrolein recovery in aqueous extractive distillation is reported to be above 99%.

Overall, propylene oxidation to acrolein may be carried out in yield above 80%. Compared to the classical aldehyde condensation route to acrolein, propylene oxidation has the important advantage of low raw-materials cost. On the debit side is the requirement: (1) to operate at low conversion per pass, (2) the need to recover acrolein from very dilute reactor gas, and (3) the complexity of the product mixture which calls for special purification methods. These difficulties have now been solved successfully, and production of acrolein may be expected to be a propylene consumer of growing importance.

IV—Production of Glycerin

Since its commercial debut in 1949, propylene-derived glycerin has made rapid strides, reaching a 1957 output in the USA which is estimated at 100 million pounds. Total domestic glycerin output during that year was 238 million pounds. The growth of the synthetic product has come about despite a nearly stagnant overall market for glycerin which was 240 million pounds in 1950 and 248 million pounds in 1957. Future growth is expected to be moderate, with total glycerin output in 1960 forecast at the 260-million-pound level.

The successful expansion of synthetic glycerine has taken place mainly at the cost of natural glycerin, which is obtained as byproduct in the manufacture of soap and fatty acids. The timing for such displacement has been opportune; it coincided with the slackening of soap sales in the face of competition from synthetic detergents.

The effect of synthetic glycerin entry into the market has been a short-term price stabilization and long-term downward pressure on the price of the polyol which had heretofore been characterized by large cost fluctuations. In March 1958, glycerin was quoted at 27¾ cents per pound in tank-car lots. This compares with 53 cents in 1951 and 1952.

Alkyd resins for the paint industry constitute by far the most important outlet for glycerin. This situation prevails despite the growing popularity of competitive

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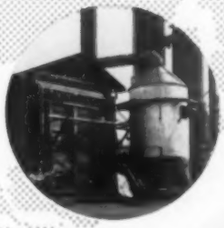

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polyhydric alcohols such as pentaerythritol, sorbitol, and such newcomers as trimethanol propane and trimethanol ethane. But outside the pale of the surface-coatings industry, glycerin also finds wide acceptance—and nearly 2,000 commercial applications are today reported for it. The following distribution pattern is currently typical for glycerin outlets:

	%
Alkyd resins and ester gums	30
Tobacco	12
Explosives	12
Cellophane	11
Cosmetics and dentifrices	5
Drugs and pharmaceuticals	5
Corks and gaskets	5
Other	20

Today, two companies—Shell and Dow—are engaged in the manufacture of synthetic glycerin. Shell Chemical Co.'s Deer Park, Texas, plant is rated at 80 million pounds capacity, but can reportedly produce as much as 100 million pounds per year. Part of the allyl chloride, which serves as intermediate in this synthesis, is produced at Shell's Norco, La., plant.

Since mid-1955, Dow Chemical Co. has been the second producer of synthetic glycerin in the USA. Capacity of this company's original facilities, plus an expansion now under way, will total approximately 70 million pounds per year.

Less clearly defined are the plans of Carbide and Carbon Chemicals Co. and Olin-Mathieson Co., both of which have announced their intention of entering synthetic glycerin manufacture.

All of these plants produce glycerin by the ally-chloride route, which Shell pioneered in 1949. This process provides an added dividend from the sale of epichlorohydrin, which can be obtained at an intermediate stage. This product serves as raw material in the manufacture of epoxy resins which are now at a stage of rapidly expanding acceptance in paint formulations.

A completely different process for the synthesis of glycerin is expected to be commercialized in the near future at Shell Chemical Co.'s Norco, La., plant. The new method also employs propylene as raw material, but acrolein and hydrogen peroxide—rather than allyl chloride—serve as intermediates. Consumption of chlorine, which amounts to 2 lb per pound of glycerin in the allyl-chloride route, is thus eliminated.

Both of these methods of synthesis are of sufficient actual or potential importance in the field of propylene chemistry to warrant somewhat more detailed examination.

IV(a) The Allyl Chloride Route to Glycerin

Three main chemical steps are involved in the "classical" allyl-chloride route to glycerin: substitutive chlorination of propylene to allyl chloride [equation (9)], chlorohydrination to glycerin dichlorohydrin [equation (10)], hydrolysis to glycerin [equation (11)].

CHLORINATION:

$$CH_3-CH=CH_2 + Cl_2 \longrightarrow ClCH_2-CH=CH_2 + HCl \quad (9)$$

ALLYL CHLORIDE

CHLOROHYDRINATION:

$$ClCH_2-CH=CH_2 \xrightarrow{HOCl} ClCH_2-CH(OH)-CH_2Cl \quad (10)$$

GLYCERIN DICHLOROHYDRIN

HYDROLYSIS:

$$ClCH_2-CH(OH)-CH_2Cl \xrightarrow{LIME} Cl\cdot CH_2-CH-CH_2 \xrightarrow{NaOH} CH_2-CH-CH_2 \quad (11)$$

(O bridge; OH OH OH)

EPICHLOROHYDRIN

It will be noted that the hydrolysis step yields epichlorohydrin as intermediate. Reference has been made above to the commercial significance of this material.

Key to the first step, the synthesis of allyl chloride, is the use of sufficiently high temperature to favor substitution over additional chlorination (the latter reaction would lead to propylene dichloride). Aside from reaction temperature, the chief process variables are chlorine-propylene ratio (which is critical), residence time, and pressure.

In the commercial plant, reaction temperature is held between 500 C and 530 C. This is the optimum range. At lower temperatures, additional chlorination makes inroads into allyl-chloride yield, whereas higher temperatures lead to excessive carbon formation. Uniformity of reaction temperature is aimed at in the converter, which consists essentially of empty steel tubes set into a shell. A highly efficient mixing jet is provided at the entrance to minimize occurrence of high chlorine-hydrocarbon ratios near the mix points.

The desired temperature control is achieved by introducing cold chlorine and propylene at 400 C. Reaction occurs immediately upon mixing, and raises the system temperature to 500 C to 530 C at the preferred reactants ratio (approximately 1:5). Chlorine conversion inside the reactor is over 99%. The remaining small quantity of chlorine will add to the double bond of propylene at the lower tempratures which obtain in the recovery section so that its consumption is, in effect, quantitative.

Useful yield increases with rising propylene-chlorine feed ratio. A high concentration of chlorine favors yield-consuming chlorination of the desired product. Thus, Williams reports that increase in propylene-chlorine ratio from 3 to 5 raised allyl-chloride yield to 80% from 66% in a linear relationship. High ratios are, of course, accompanied by reduced throughput and by increased load on the recovery system, as a larger amount of excess propylene must be handled and recycled. Economic considerations set the upper limit to reactants ratio at about 5.0 to 5.5.

Neither residence time nor pressure is very critical in allyl-chloride synthesis. Enough time is allowed for substantially complete chlorine conversion in the reactor. This objective is accomplished within about 1.5 sec (at 500 C to 510 C).

The Deer Park allyl-chloride plant is operated at 15 psig, sufficient to cover flow requirements of the recovery system. The chlorination reaction itself is scarcely affected by pressure, but extent of carbonization increases very gradually as reactor pressure is boosted.

The converter make is cooled to 50 C and fed to a prefractionator column for the separation of HCl and propylene from higher-boilers. Its tower top is operated at −40 C. At the original Deer Park installation, the overhead is water-scrubbed for recovery of 32% hydrochloric acid. Propylene is recycled following a caustic wash and drying. Allyl chloride is recovered from the prefractionator tower's bottoms liquor by fractional distillation in two columns, operated in series. In the first of these, lighter components are separated. The bottoms are fed to the final fractionator for overhead recovery of commercial-grade allyl chloride.

Conversion of allyl chloride to glycerol dichlorohydrin [equation (10)] is carried out in the presence of aqueous phase. Allyl chloride is injected into a stream of water (or sodium-hypochlorite solution) in which chlorine has been dissolved. Intimate contact between allyl chloride and the aqueous reaction phase must be provided. Care must be taken to minimize contact of allyl chloride with gaseous chlorine. Williams reports dichlorohydrin yield of 91.4% (based on allyl chloride) for carefully controlled chlorohydrination carried out at 28 C.

The last step in the allyl-chloride route to synthetic glycerin is shown in equation (11). For direct conversion of glycerol dichlorohydrin to glycerin, the use of lime is not suitable because the product cannot be successfully distilled from byproduct calcium chloride. The reaction may be carried out in good yield (better than 90%) by contacting the crude dichlorohydrin with aqueous alkali containing 10% NaOH and 1% Na_2CO_3. In the hydrolysis of the chlorohydrin, the preferred operating temperature is 150 C, with a contact time of 30 min.

An alternative route to glycerin via the epichlorohydrin permits the replacement of about one-half of the caustic soda by cheaper lime. Glycerol epichlorohydrin, the intermediate product, is readily hydrolized to glycerol by treatment with caustic soda and soda ash.

In either production method, the crude glycerol is concentrated to 85% strength in flash evaporators. Further purification to 99%+ is effected by a combination of solvent extraction (with xylene) and vacuum fractionation.

Note: Balance of this article and bibliography will appear in a subsequent issue. End.

BP MAPS THE FUTURE

Minutes saved in fuelling an aircraft mean a quicker journey for its passengers. Here, at Lisbon Airport, a BP man connects a mobile dispenser to the hydrant pit of the underground pipeline. The huge plane will be completely fuelled in about 15 minutes.

1200 Gallons a Minute

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AIRLINERS HAVE A MAMMOTH THIRST. Today's biggest planes need as much as 18,000 gallons when they are fuelled. Tomorrow's planes will need 'fill-ups' of 24,000 gallons.

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How It Operates

Previously, fuel was always brought to an aircraft by a mobile tank fueller. Now, with the Hydrant System, it may be piped from the airfield depot direct to a hydrant on the concrete apron. From the hydrant the fuel passes to a mobile fuel dispenser which filters and controls its flow, and from this to the aircraft.

Torrential Speed

The great advantage of the Hydrant System is that virtually unlimited quantities of fuel can be delivered at *torrential speed – with complete safety*. In principle the system is simple but (particularly because of the pressures set up) to make it practicable has involved an immense amount of research and experiment by BP technicians.

This new development in aircraft refuelling is just one more way in which The British Petroleum Company plans for the future – today.

THE BRITISH PETROLEUM COMPANY LIMITED

INTERNATIONAL NEWS AND NOTES

A 100-ton 125-ft "vessel" for storing LPGas, which was purchased in The Netherlands for Arabian American Oil Co., is barged down the canals of the Low Countries to Antwerp en route to Aramco's refinery at Ras Tanura on the Persian Gulf coast of Saudi Arabia.

Tanker Rates Still Depressed

Continued oversupply of tanker tonnage worldwide has forced freight rates for petroleum and petroleum products to their lowest level in the last 10 years, according to a research report of Am. Merchant Marine Inst. Not only are tanker freight rates low, but they have remained at a reduced level since shortly after the reopening of the Suez Canal early in 1957. These reduced rates have resulted in the layup of tanker tonnage worldwide. In fact, by mid-1958, tanker tonnage in layup (US and foreign flag) in world ports exceeded 6 million dwt. There was very little, if any, tanker tonnage in layup 12 months ago for lack of cargo.

Inactive US flag tanker tonnage on July 1, 1958, totaled 971,000 dwt tons, almost double the 490,000 dwt inactive beginning of 1958, and over five times the tanker tonnage idle in July 1957. Over three-quarters of the inactive tonnage under US flag on July 1, 1958 was idle due to inability to find cargoes.

On July 1, 1958, according to the report, US flag privately-owned ocean-going tanker fleet totaled 327 vessels of 5,838,210 dwt, representing a loss of only one vessel but a net gain of over 56,000 dwt since January. This increase in tonnage resulted when four tankers of 132,150 dwt were added from new construction. Removals from our privately-owned tanker fleet during the first six months of 1958 totaled five vessels of 76,053 dwt by transfer or sale abroad.

RUSSELL D. RICHARDSON has been named vice president-finance of Tidewater Oil Co., retaining his present responsibilities as treasurer and controller. He began his career with Tidewater in 1921, and in 1954 he was elected controller of the entire company. He assumed the additional post of treasurer in 1957.

Germany's Remote-Controlled Line

Six West German refineries are expected to receive crude late this year from a 230-mile "push button" pipeline, according to R. S. Cannon, of Planatation Pipe Line Co., Atlanta, Ga., who spent several months last year as an engineering advisor on the project. The pipeline, which initially will deliver 200,000 b/d of Middle East crude, is Germany's first large crude line. It is 28 in. in diameter; extends from Wilhelmshaven on the North Sea to Wesseling, a small town 20 miles south of Cologne, and is Germany's largest. It will be remotely operated from Wilhelmshaven. Initially there will be one pumping station at Wilhelmshaven, but an intermediate station is planned for 1960 to increase throughput to 350,000 b/d. Two more pumping stations are expected to be required by 1965.

The four unmanned stations will be controlled from Wilhelmshaven, and takeoff valves for refinery delivery also will be remotely controlled from Wilhelmshaven. The sequence control and protective scheme worked out for the pump stations follows modern practices in the United States.

Israel Wildcat

Drilling operations were begun in August by American-financed companies, Pan-Israel Oil Co. Inc. and Israel-Mediterranean Petroleum Inc., 20 miles southeast of Tel Aviv. The well, to be drilled to 8,000 ft, is located on a joint 98,000-acre concession. According to H. I. Harris, chief geologist, the joint venture will seek oil in the Heletz sands which now produce approximately 2,000 b/d from 20 wells in the nearby Heletz field, and will also investigate deeper prospective reservoirs. He said the well will require approximately three months to reach its total depth.

R. D. Richardson

K. C. Thompson

G. J. Smith

D. W. Farnham

Halbouty in Alaska

Houston independent oil operator Michel T. Halbouty has announced formation of Halbouty Alaska Oil Co., to be known as Halasko. New firm will manage approximately 1,250,000 acres of mineral lands in the Union's newest state. Capitalized at $1 million, corporation was chartered in Delaware to explore, drill, produce, refine, and transport oil and gas and to engage in related activities. Company headquarters will be in Houston in the Halbouty Building at 5111 Westheimer Road. Offices will be opened immediately in Anchorage and in Denver. Company will begin first operations early next spring in either the Kenai or Porcupine basins.

The 1,250,000 acres are located in the Kenai basin (which includes the Kenai peninsula), in the Porcupine basin, Koyukuk Cretaceas basin, Nushagak basin, Bethel basin, and the Alaskan peninsula.

Two Denver oil men, Raymond M. Thompson and Don R. Link, with experience in Alaska, have joined the corporation as vice presidents. Mr. Thompson, an Alaska authority, who will head company's exploration division, was formerly with the US Geological Survey. He recently spent three years in the new state making extensive studies of the vast mineral lands there.

Mr. Link was named to head the company's land division. He has gained experience in land acquisition in Alaska during the past several years and is widely known in the new state.

Mr. Halbouty first became interested in Alaska and started studying its geology about three years ago. He recently returned from an investigative trip in which he spent three weeks flying, driving, and walking over his land holdings.

Directors of Halasko are Mr. Halbouty, president and board chairman; George C. Hardin, Jr., executive vice president; Messrs. Thompson and Link; James Noel, general counsel and secretary; Frank K. Bruce, Jr., treasurer and comptroller; and Fay Renfro Halbouty. Other principals are James L. Ward, vice president, drilling and production; R. E. Anderson, assistant secretary; Louis J. Darilek, assistant treasurer and chief accountant; T. E. Dobson, chief petroleum engineer and J. E. Etheridge, land manager.

Michel T. Halbouty was born, 1910, in Beaumont, Texas, locale of the famous Spindletop field, and is co-author with J. A. Clark of the book SPINDLETOP describing the "big hill." During the 30's he was vice president, general manager, and chief geologist for Glenn H. McCarthy Inc. He has assisted in the discovery of a number of Mid Continent and Southwest oil fields, including Spindletop. During World War II he was a consultant to the Army-Navy Petroleum Board. He now conducts his own consulting geology and petroleum engineering firm in Houston.

Tunisian Concession Contract

Tunisia has given final approval to a concession contract with Conorada Petroleum Corp., covering exploration of 28,356 square kilometers. Conorada will pay 15% royalty on production, plus 50% of any profits after royalties and taxes, and will spend the first five years a minimum of 1.6 billion francs.

Conorada plans to spend months in preliminary exploration, but drilling may start before the end of this year.

Conorada has 22 persons in Tunisia, in all. The American staff consists of a managing director, an exploration manager, and three field geologists. The firm employs an Australian field geologist and 12 local or European field staff persons, plus five on the office staff.

Pan Am International Moves

Transfer of Pan American Petroleum Corp.'s overseas operations in the Western Hemisphere to the jurisdiction of its subsidiary, Pan American International Oil Co., has been announced by E. F. Bullard, chairman of Pan American Petroleum.

G. J. Smith, D. W. Farnham, and K. C. Thompson have moved from Tulsa to the New York offices of Pan American International. All three have been associated with exploration, drilling, and production activities of Pan American Petroleum subsidiaries operating in the Caribbean area.

Activities on the North American continent will continue to be handled by Pan American Petroleum. Current overseas operations being transferred to Pan Am International are in Cuba and Venezuela.

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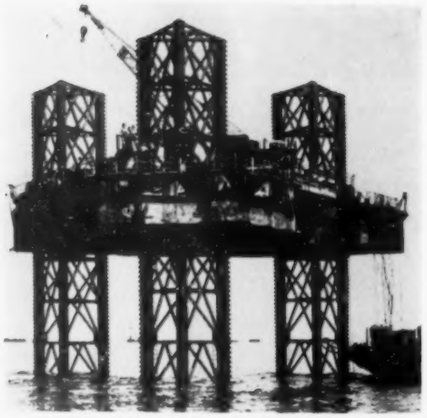


Aramco's Mobile Drilling Platform No. 1 undergoes fitting-out operations at the Ras Tanura terminal in the Persian Gulf. The three legs measure 108 ft each following addition of top sections, which were stowed on deck for the 10,000-mile voyage from Vicksburg, Miss. The triangular platform, built by R. G. LeTourneau Inc., of Longview Texas, is 93 ft long, 104 ft wide, and weighs about 800 tons without drilling equipment. An Aramco spokesman said it is to be elevated 10 ft above surface of the water during drilling operations.

Kuwait Oil Exports

Kuwait Oil Co. crude exports in first half of this year came to 226,947,050 bbl. Distillate exports were 1,851,439 bbl; diesel oil, 287,765 bbl; gas oil, 2,199,360 bbl; heavy fuel oil, 2,189,853 bbl; and light diesel oil, 195,033 bbl.

United Kingdom was destination of 72,464,588 bbl of KOC crude; USA was second, with 33,161,663.

Gas-Condensate Plant

A small refining plant for the production of diesel fuel, kerosine, and naphtha is being installed on the Sui gas line in Pakistan. The plant will fractionate about 10 b/d of gas-line condensate. The line now is handling 39 million cubic feet of gas per day.

Esso's Wales Refinery

Esso Petroleum Ltd. has signed contract with Foster Wheeler for 100,000 b/sd refinery at deep-water port of Milford Haven, Wales. $35 million refinery will be located on 350-acre tract, and served by a 3,500-ft tanker jetty capable of accommodating 100,000-ton supertankers. Project should reduce imports of finished oil products. The new refinery, along with Esso refinery at Fawley, England, currently being expanded to 220,000 b/sd, will be able to supply about 37% of Britain's domestic oil needs.

Cost of refinery, tankage, and deep-water port facilities will be about $50 million, and refinery phase should take a little over two years to build with peak construction force of 2,000. Process design is by Esso Research & Engineering; mechanical design and procurement by Foster Wheeler Ltd. of London. Major process units include 100,000 b/sd atmospheric distillation and stabilizer; 16,500 b/sd Powerformer; 16,500 b/sd gas-oil Hydrofiner; 31,500 b/sd gas-oil drying unit; and copper-chloride sweetening facilities.

Gulf Consolidates in London

Gulf Eastern Co., a Gulf Oil Corp. subsidiary, has announced an organizational change affecting two of the departments of its London office. Effective September 1, function of supply department concerned with coordination of product supply in the Eastern Hemisphere was taken over by manufacturing department and carried on as a unit of that department. Manufacturing department, headed by H. W. Magee, manager, is located at present at 75 Brook St., London.

Angola Increases Refining

Due to increased refinery production at home, Angola imports of oil products in the first four months of this year came to 30,860 metric tons (32,234 last year).

Sun in New South Wales

Sun Oil Co. of California plans to drill a number of test wells in lower Hunter River valley in central New South Wales, Australia. S. W. Mellon, president, said company would explore extensive upper and lower marine formations within the margin of the Great Sydney Basin; that within past year he had also arranged to explore several potential areas for oil and gas in Queensland. If oil and gas is discovered, an Australian company is to be formed for development.

A Canadian firm, Humber Oils Ltd., Calgary, has been granted a permit by the Department of Mines to explore for oil on 53,000 square miles of the Barrier Reef off the coast of Queensland. Drilling to 6,000 ft deep is planned from floating platforms.

French Government Oil

The French agency for petroleum exploration and development, Bureau de Récherches de Pétroles (BRP) has published its annual report on activities of its related companies in France and French Overseas Territories. This is an unusually complete report with accompanying maps at concessions and wells, of operations by over 50 companies in which BRP has in interest. The information is not available in any other single source in such complete form. The report, called *Rapport Annuel sur les Réchèrches de Pétrole en France Métropolitaine, En Afrique du Nord and dan les Territorires d'Outre-Mer*, is available through BRP's offices at 12, Rue Jean-Nicot, Paris, France.

Tunisian Imports

Tunisian imports of petroleum products in 1957 totaled more than 400,000 metric tons, with all but about 65,000 tons coming from France, according to Assn. of Importers of Petroleum Products for that country.

Broken down, 1957 imports included 189,500 metric tons of heavy fuel oil, 99,250 tons of gas oil, 71,250 tons of gasoline and super gasoline, 38,600 tons of kerosine, and 4,290 tons of aviation gasoline.

In sales, Esso lead with 36.4% of all petroleum product sales. Shell held 23.8% Mobil 6%, Ozo 6.9%; Mory 11.7%; Purfina 12.3%; Motocoop 1.8% and other 1.1%.

Reportedly all imports from the United States, while relatively small, were financed by ICA under its commodity import program. Substantial part of imports fro mother places also fell under the ICA program.

Cameroons Seismic Work

Shell-BP has opened four months of seismic operations over 40-square-mile area in Ric-del-Ray swamps of southern Cameroons, with base at Ikang in Calabar province. Seismic party will have up to 300 persons.

New Kuwait Gathering Centers

Two new gathering centers, No. 12 and 13, have been commissioned in the Burgan oil field of Kuwait Oil Co., in which BP has a 50% interest. The installations, which comprise essentially a pipeline from each well, gas-oil separators, tankage and pumps, were constructed by local contractors under the supervision of the company's engineering department.

With these latest developments in the Burgan field, there were at the end of June 11 gathering centers serving 211 wells. Two other gathering centers serve the Magwa-Ahmadi fields to the north where, at the end of June, there were 76 wells.

Abandons Nigerian Well

Shell-BP has abandoned an exploration well at Uda in Eket division, Calabar province of Nigeria. Started March 30, the well went to 11,312 ft, finding no trace of oil or gas. Drilling rig was moved to Uquo, also in Eket division, where drilling is to start on another exploration well.

Franco-Swiss Alpine Survey

Four scientists from BP's exploration and production laboratory at Sunbury left England recently for Franco-Swiss border, to take part in large-scale seismic operations in the Alps.

Continental in Alaska

Continental Oil Co. is joining Colorado Oil & Gas Co., Denver, and Frankfort Oil Co., Dallas, in the exploration of some 1,100,000 acres of oil and gas rights in the Yakutat area along the southeastern coast of Alaska. The block of acreage is approximetely 140 miles long, and is situated 240 miles northwest of Juneau, the Alaskan capitol, and about 1,200 miles from Seattle. It is the largest single land holding to date in Alaska. Colorado Oil & Gas and Frankfort, which hold the oil and gas rights, have drilled two exploratory test wells with oil and gas indications. A third test now in progress is projected to the depth of 11,000 ft.

In addition to the drilling, Colorado Oil & Gas and Frankfort have since 1956 conducted in the area extensive seismograph, gravitymeter and surface geological surveys.

The agreement is subject to the approval of the Secretary of the Interior. It provides Continental may earn a one-third interest in the Alaskan properties upon the performance of certain exploration work extending through 1959 and into 1960.

First Deep Maltese Test

Drilling of first deep test in Malta by BP Exploration Co. was begun Sept. 1. To be drilled near the village of Naxxar about four miles north west of Valletta, the well will be known as Naxxar No. 2. A shallow exploration well was drilled in the vicinity in 1955. A 15,000-ft rig has been brought from Sicily where BP is searching for oil. Early this year the Maltese government granted BP a new license to explore for oil in the Maltese Islands. Previously the company had carried out under license a geophysical survey of Malta.

Philippine Acreage Up 65%

At the start of this year, a total of 7,052,610 hectares in the Philippines was covered by grants of oil exploration concessions or applications for concessions, up 65% over 4,266,044 hectares a year earlier. Twelve companies held concessions on 4,788,540 hectares, and these 12 also had pending applications for an additional 1,163,722 hectares. Five other firms or individuals had applications on file for an additional 1,100,348 hectares.

Drilling in Austria

RAG's well Steindlberg No. 1 in Upper Austria encountered traces of oil in several sandstone layers between 6,322 ft and 6,398 ft. Drilling is to continue to the crystalline bedrock in about 9,166 ft. Afterwards, production tests are to be made.

The seismic exploration by the West German company PRAKLA for Vorarlberger Erdoelges mbH has been finished in Austria's westernmost province of Vorarlberg.

Austrian Deliveries Cut

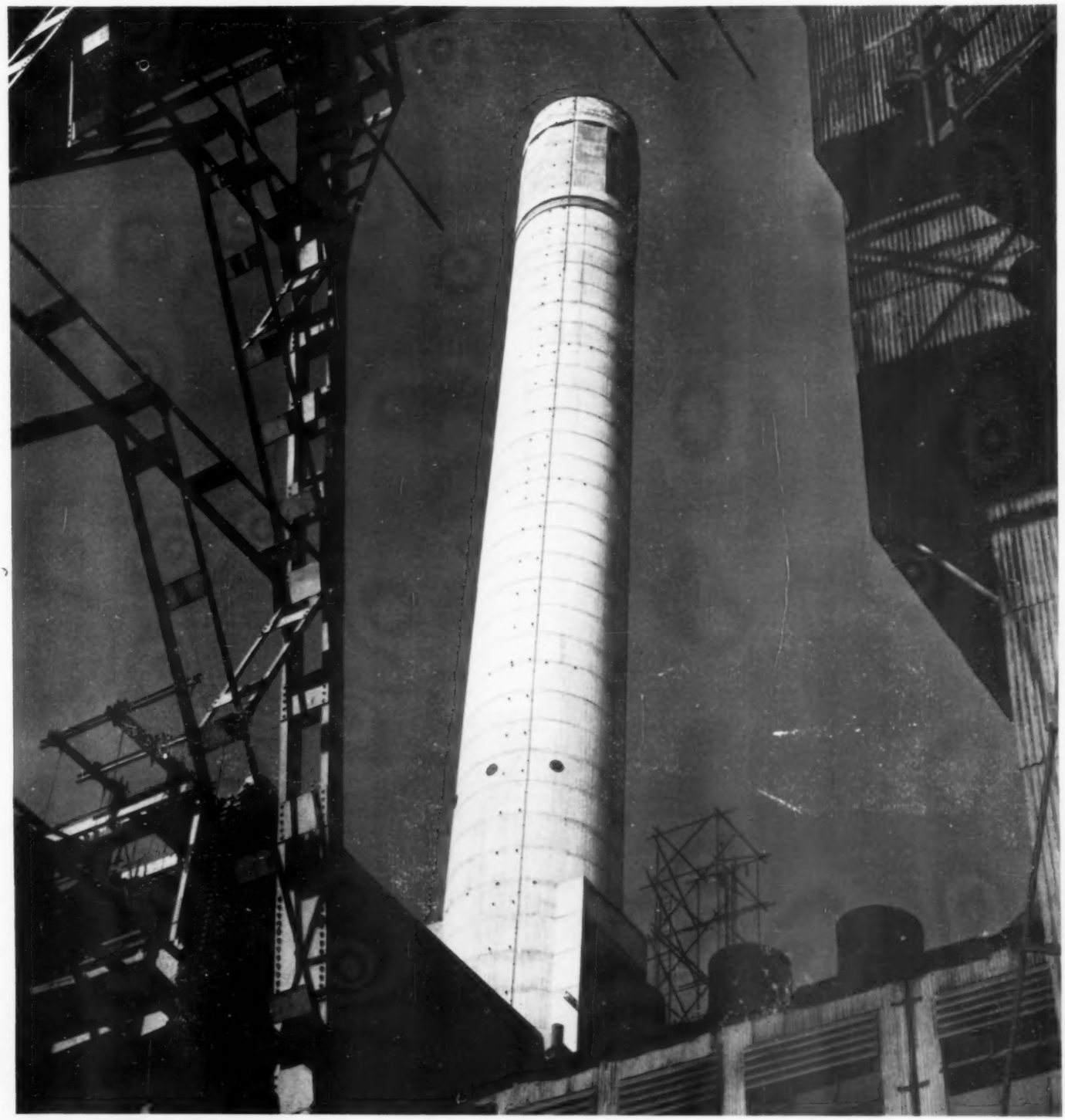
The Soviet government has agreed to cut by 50% the still outstanding Austrian crude-oil delivery quota of seven million tons (52.5 million barrels, approx.). Under the terms of the State Treaty of 1955, the USSR was to receive from Austria (in addition to other materials) 10 million tons of crude oil. The reduction will save Austria about $60 million.

Austria's oil never actually went to the USSR but to Hungary, Czechoslovakia, Poland, and East Germany, covering about one-quarter of their import requirements. Austria will continue delivery of the remaining seven million tons of oil, while the Soviet Union will supply to Austria 3.5 million tons of Soviet oil as of January 1, 1959. The USSR promised that her oil, to be delivered in annual consignments of 500,000 tons, will be of standard quality and would be delivered either f.o.b. Austrian border or c.i.f. Austrian Danube port.

Neutral Zone Crude Exports

Getty Oil Co. exports of crude from the Kuwait-Saudi Arabia Neutral Zone during the first six months of this year were 7,098,287 bbl; American Oil Co. 5,001,728 bbl.

Of Getty's exports, 6,803,115 bbl went to USA and 295,172 to Japan. Of Aminoil's exports, 994,821 bbl went to USA, and the rest to Japan (1,233,437), Netherlands (551,660), Italy (588,080), and France (1,633,730).



CENTRAL ELECTRICITY GENERATING BOARD. NORTHAMPTON POWER STATION.

Reinforced concrete chimney supported on structural steel framework and rising 160 feet above the Power House roof.

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Electronic Controls

(Continued from page 53)

the contrary, their cost is much higher than that of conventional equipment. But the advantage is that electronic instruments can be easily repaired, in that they may be easily removed and immediately replaced by new ones. Moreover, electronic apparatus responds more quickly and enables us to lay the foundation for entirely automatic operations. The system can also be used for the making of "punch cards," and so will contribute to automatic registration and evaluation of the data obtained.

"There is yet another advantage, and that is that this equipment takes up less space on the control-panels which are nowadays generally employed. A control-panel such as we will install in our main control-room here in Rotterdam will require roughly 20% less space than the conventional apparatus.

"We cherish high expectations of electronic instruments not only for control of our processes, but also for their use in measuring fluid levels in tanks.

"In order to function efficiently, a concern like ours has to know the exact quantities of what is received, produced, and delivered. This is also very important for the State, as it has considerable interest in the quantities of our product.

"In view of the ever-increasing size of the tanks, more and more exact measurements are called for. In the case of our biggest tank, a reading error of as little as 1 millimeter makes a difference of 1,640 liters. In our opinion, readings by means of automatic apparatus are more exact than the results obtained with the measuring tape. It is very difficult to convert this greater accuracy into figures, but very generally one can say that the deviations of automatic measurings are 25% smaller than those of tape measurings."

Much of the product of the new plant will move to market in barges through the extensive local system of canals. Designers of the plant will speed up barge loading by installing a system similar to that employed at the usual tank-truck dock. Barges will be moored under a pipe gantry and loaded through movable arms. Movement in and out of the loading area will be expedited by the employment of ship-to-shore telephones from barges to dispatcher's office. END

Oil is our cup of tea. Not literally, of course, but we do have considerable knowledge of the oil business in Canada. The Supervisor of our Oil and Gas Department keeps us fully up to date on all aspects of this important Canadian Industry. Over the years, Imperial Bank has made it a policy to keep a finger on the ever-changing pulse of the nation's business and industry. Contact with the Supervisor, Oil and Gas Department, Imperial Bank of Canada, 001 Mobil Oil Building, Calgary, Alberta, will keep you informed of business opportunities and developments.

IMPERIAL
BANK OF CANADA
HEAD OFFICE, TORONTO 1, CANADA.

Quebec Natural Grows

(Continued from page 46)

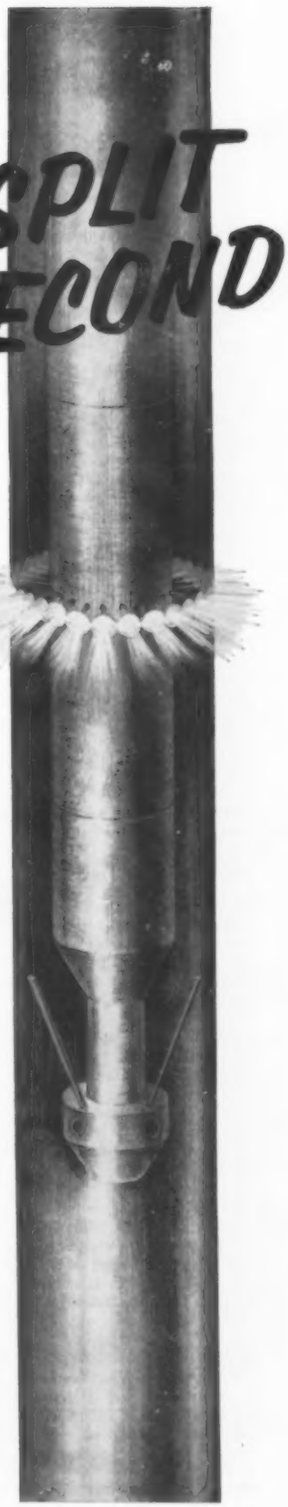
progressive Canadian and USA business concerns. Employee services include a safety program; insurance, medical, social, and retirement benefits. An up-to-date cafeteria also is provided.

The corporation has embarked on a vigorous and enlightened market development program, designed to enhance the area's economy. Montreal has abundant manpower, raw materials, and unlimited power facilities, particularly with respect to *natural-gas* reserves. Because it is a national and international cross-roads, Montreal is in a strategic position to benefit from and contribute to Canada's growth and development. Not only should Montreal soon top the list of natural-gas consumers in Canada, but should rank high among gas-consuming communities on the North American continent.

The Financial Post of Toronto has forecast the future of Quebec Natural Gas Corp. as follows: "Eventually, all this should help this utility become one of the most successful in the country—for the benefit of both its customers and its shareholders." END

Don Collins (right) of Republic Supply Co., chairman of Nomads Committee for International Petroleum Exposition, looks over an engraved invitation to be used to invite international delegates to the IPE next May, 14-23. NOMADS in the Houston, Dallas-Fort Worth, Los Angeles, New York, and Tulsa Chapters will send invitations to their customers. Tulsa NOMADS, R. C. Glover (left) of Baker Oil Tools, and N. M. Cooley of Bethlehem Supply Co., check the invitation with Collins.

Cuts tubing in a SPLIT SECOND



CHEMICAL CUTTER RECOVERS 13,788′ OF TUBING

This oil well was a dual completion with two strings of tubing inside 7″ OD casing. Operator was unable to pull 2″ tubing. McCullough Magna-Tector (Free Point Finder) was run—found packer stuck at 13,899′. An unsuccessful attempt was made to jar the packer loose with a String Shot.

McCullough Chemical Tubing Cutter was then run to 13,788′, cut was made and tubing removed from the hole. All wire line operations were completed in nine hours rig time in spite of severe complications—extreme depth, tubing restricted by choke valves, and 800 lbs. pressure on tubing during operations.

McCullough®

CHEMICAL TUBING CUTTER

Here's a "split-second" tubing cutter that will save more than 80% of the rig time usually required to cut tubing by mechanical methods. It is an electric wire line tool which applies the enormous power of the halogen fluorides to cut through tubing quick as a wink.

McCullough's Chemical Cutter makes a clean, flare-free cut—no burrs nor distortion on either the OD or ID of the tubing. Cutting operation is junk free, since no part of the cutter is expendable. It will not damage casing even though the tubing be as close as 1/64″.

Ask your McCullough Service Engineer about this revolutionary new service. Available for 2″ or 2-1/2″ tubing at all McCullough Service Locations.

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OIL COMPANY STAFF CHANGES

K. King

O. J. Dorwin

M. J. Epley, Jr.

H. T. Holden

OSCAR JOHN DORWIN has been elected senior vice president of The Texas Co., New York, and continues as general counsel. A director since 1957, he formerly was vice president. **MARION J. EPLEY, Jr.**, assistant to the chairman, has been elected a vice president **KERRYN KING**, formerly general manager of the industrial and public-relations department, has been elected vice president in charge of that department.

Mr. Dorwin has been associated with Texaco since 1931, and general counsel since 1944. Mr. Epley joined Texaco's legal department in 1947 in New Orleans. Named chief attorney for the company in Louisiana in 1948, five years later he transferred to New York and become general attorney. Mr. King joined Texaco in 1953 as director of public relations.

KIRBY E. CRENSHAW has been elected president of Cities Service Gas Co., Oklahoma City, Okla. He succeeds Harry D. Hancock, retired. Mr. Crenshaw has been executive vice president of the company since 1956.

R. E. GRISWOLD has been appointed staff geologist of The Texas Co.'s domestic producing department at New York. He joined Texaco in 1949 following his graduation from Syracuse University. He recently served as assistant division geologist at Denver.

ROBERT C. GUNNESS, executive vice president of Standard Oil Co. (Ind.), was elected a member of the board of trustees of the University of Chicago, August 14.

ALBION E. STEBBINGS has been elected a director and appointed general manager of the sales department for Signal Oil & Gas Co., Los Angeles. Mr. Stebbings will assist O. W. March, vice president and director, who will continue as head of the company's marketing operations.

W. S. FRISBIE has been appointed special representative of Falcon Seaboard Drilling Co., Tulsa. He has had more than 20 years oil-field experience, starting with Frick-Reid Supply in 1936. He then started in the drilling business as assistant to the president of Parker Drilling from 1944 to 1948, before organizing Frisbie and Yancey Drilling Co. in West Texas and New Mexico.

W. DOYLE MILLER has been elected a director of Seminole Oil & Gas Corp. At present Mr. Miller is an independent petroleum and management consultant in Dallas, Texas, and Wichita, Kans; president of Miller Petroleum Co., a driller in Canada, and a former vice president of Dresser Industries Inc.

JOESPH ANDREAE and **ROBERT W. MOUNTREY** have been appointed vice presidents of Esso Tankers Inc., New York, newly created marine affiliate of Standard Oil Co. (N.J.). **EDWIN L. STEWART** has been appointed special assistant to the president, J.M.B Howard.

DAVID R. WILLIAMS, JR., a director of Williams Brothers Co. of Tulsa and vice president of the company's Canadian associate, Dutton-Williams Brothers Ltd., Calgary, has been named a director of Canadian Hydorcarbons. Mr. Williams served as project engineer on the Trans-Arabian Pipe Line project; then became general superintendent of the company and subsequently vice president, operations.

DAVID T. SEARLS has been elected general counsel of Gulf Oil Corp., Pittsburgh—succeeding Archie D. Gray, designated a senior vice president last April. At the time of his election as Gulf's general counsel, he was a senior partner of Vinson, Elkins, Weens, and Searls, of Houston.

T. KEITH GLENNAN, a director of Standard Oil Co. (Ohio) has become director of the newly created National Aeronautics and Space Administration by nomination of President Eisenhower. He has taken an indefinite leave of absence as president of Case Inst. of Technology.

J. E. BOUNDS, administrative vice president, has been appointed coordinator of the financial department of Gulf Oil Corp., Pittsburgh. **W. T. GRUMMER** is acting comptroller, and **W. L. HENRY** is director of taxes. H. R. Moorhead is treasurer.

J. G. A. M. BIERMAN age 61, director of Royal Dutch-Shell operations in Curacao for the past two years, has returned to The Netherlands to retire from the company. **J. H. VELDERS**, who was born in Enspijk in 1911 has arrived to replace him. Mr. Velders has been with the Royal Dutch-Shell group in various posts in the Dutch East Indies, and was with Shell Oil Co. in the USA in 1942.

SERGE B. JURENEV, of New York, and **HOWARD H. HINSON**, of Houston, have been elected directors of Continental Oil Co. Mr. Jurenev is assistant to the president and chief economist of Continental, and Mr. Hinson is vice president and general manager of the company's foreign department. **JAMES J. COSGROVE** board chairman, and **E. F. BATTSON**, both of New York, have resigned from Continental's board.

FRANK O. PRIOR, chairman and chief executive officer of Standard Oil Co. (Indiana), Chicago, has been elected a director of the Chase Manhattan bank.

IRA H. CRAM, Houston geologist, has been elected chairman of the executive committee of Continental Oil Co.'s board. Mr. Cram, who is a director and senior vice president of Continental, succeeds E. F. Battson, New York, retired. Mr. Cram joined Conoco in 1949 as vice president and manager of exploration. He was elected to the board in 1952, and became senior vice president the following year.

HANS. C. JENSEN of Pittsburgh, Pa., has been named petroleum transportation and storage specialist in the Office of Oil and Gas of the Department of the Interior. He succeeds Earl Ellerbrake who resigned August 1, to return to his company, Standard Oil Co. (Ohio).

Mr. Jensen joined Gulf Oil Corp. in 1947 as assistant technical representative in the foreign marketing department. From 1951 to 1954 he was an engineering and operations consultant to Gulf's European subsidiaries. From 1954 until 1956 he was operations manager for a division office in Brazil. Since May 1956, he has been director of transportation planning and programming.

O. WARREN HILLGREN has been named manager, market promotion and development, for the Wilshire Oil Co. of California, Los Angeles. The newly created department will be responsible for all company advertising and public-relations activities, and will include sales promotion, dealer and distributor training, TBA and lubricant merchandising and general market development.

RAWLEIGH WARNER Jr., formerly head of economics department, has been appointed manager of the department of Middle East affairs for Socony Mobil Oil Co. Inc., New York. He is succeeded by **THOMAS W. PHELPS**, formerly assistant to the board chairman. **PAUL WOLLSTADT** succeeds Mr. Phelps. **ARNOLD STEBINGER**, formerly manager for Middle East Affairs, is now on special overseas assignment.

HAROLD T. HOLDEN has been appointed manager of export operations of the George E. Failing Co., Enid, Okla. He has been with Failing since 1954 in both domestic and foreign land operations. His office will be in the International Building, 45 Rockefeller Plaza,, New York.

KENNETH R. JOYNT has become superintendent of Magnolia Petroleum Co.'s Gulf Coast producing division, Houston, Texas. Formerly assistant superintendent, he replaces J. B. Goodrich, retired. **JOHN S. RUSSELL** will transfer to Houston from Oklahoma City and fill assistant superintendent's job.

J. P. MORONEY, senior vice president of Colorado Oil & Gas Corp., Denver, has retired. **W. G. TIERNEY**, president of the company's subsidiary, Derby Refining Co., replaces Mr. Moroney. Mr. Tierney continues as president of Derby at Wichita, Kans., and will serve as special assistant to W. C. Norman, parent-company president. **J. W. MEEHAN**, Wichita, has been elected to the Derby board and designated executive vice president and general manager. **L. M. WOODWARD** has been elected a Derby vice president at Wichita.

BERT E. GAMBLE, manager of southern region for Lion Oil Co. division of Monsanto Chemical Co., retired Oct. 1. He was succeeded by **WILBERT C. DENNIS**, chief geologist in the production and exploration headquarters.

JOHN W. TYNAN has been promoted to production manager for Continental Oil Co.'s Rocky Mountain region, with headquarters at Denver, Colo. He succeeds J. C. (Jimmy) Johnston, retired.

LOUIS J. BRUNEL, vice president and general manager of Bishop Oil Co., was elected a director of the company. He fills a vacancy created by resignation of Prentiss Moore, of Los Angeles.

FRANCIS E. HEATH has been appointed agent and chief geologist for Sun Oil Co., Southwest production division, Dallas, Texas. Formerly chief geologist, he now will function in the absence of division manager Sam H. Gladney or assistant division manager Tom F. Hill.

PAUL D. HARRYMAN has joined research department of Monsanto Chemical Co.'s Lion Oil Co. Division at Texas City, Texas. **DEAN A. ROACH** has joined the technical services department at Monsanto's organic chemicals division plant at St. Louis. **FRANK D. SHEARIN** has become a member of Monsanto's research and engineering division at Mound Laboratory, Miamisburg, Ohio, after serving with Dow Chemical Co. since 1957.

M. W. JOHNSON, president of Esso Standard do Brasil Inc., has been appointed deputy coordinator of marketing for Standard Oil Co. (N.J.), effective November 1. In his new post, Mr. Johnson follows W. A. M. Greeven, appointed shareholder representative for Jersey Standard in Italy, Austria, and Switzerland. Mr. Johnson was succeeded as president of Jeresy Standard's Brazilian marketing affiliate, October 1, by C. J. Griffin, formerly vice president there.

M. W. Johnson

C. J. Griffin

JOSEPH W. JACKSON, Jr., Denver division geologist for Sinclair Oil & Gas Co., has been named division exploration superintendent. He succeeds C. H. McClure, named asistant manager of the Tulsa division.

LEO J. BLATZ, formerly Eastern Hemisphere sales manager in the cargo sales department of Esso Export Corp., has been transferred to London as Esso Export's assistant cargo-sales advisor. Mr. Blatz began with the Standard Oil Co. (N.J.) in 1943, and joined Esso Research and Engineering Co. He transferred to Esso Export Corp. in 1954.

J. R. MUEHLBERG, former technical services division manager, Esso Export Corp., aviation department, has been transferred to London as Esso Export's aviation advisor, Eastern Hemisphere. He replaces J. C. Justice, now on a special assignment. **A. B. CRAMPTON**, former European representative of the Esso Research and Engineering Co., has joined Esso Export as technical-services division manager, replacing Mr. Muehlberg.

KENT H. SMITH, board chairman for Lubrizol Corp. and a member of the Case board of trustees, has been named acting president of Case Institute of Technology.

DR. ARTHUR S. GOW JR., has been appointed research chemist for The M. W. Kellogg Co. He was formerly with the United States Steel Co.

FRANK A. NALBACH has been appointed assistant eastern sales manager of American Mineral Spirits Co., Chicago, Ill. He succeeds Richard V. Hinman recently named eastern sales manager.

DENIS B. KEMBALL-COOK, executive vice president in charge of exploration and production for Shell Oil Co., has been elected to the board. He replaces Alan J. Galloway who is retiring after 32 years with Shell.

DR. JAMES N. PITTS, JR., associate professor of chemistry at the University of California's Riverside campus and an authority on photochemistry, has been named a consultant to Shell Development Co., Emeryville, Calif. He has obtained a leave of absence from the university.

RICHARD A. BRAMKAMP

Richard A. Bramkamp, chief geologist of Arabian American Oil Co., died September 1, at Memorial Hospital in New York. He was 48 years old. Dr. Bramkamp was one of the pioneer geologists in Saudi Arabia. His work played a major part in Aramco's discovery of the great oil reserves in that country.

Born in Richmond, Ind., Dr. Bramkamp joined Standard Oil Co. of California in 1936 as a paleontologist, and later that year transferred to Aramco for service in Saudi Arabia. He was promoted to senior paleontologist in 1944, to chief field geologist in 1947, and to chief geologist, also in 1947.

J. E. PRENDERGAST

J. E. Prendergast, 31, administrative assistant to the manager of Sun Oil Co.'s southwest production division at Dallas, died August 12, at his home in Dallas, following a heart attack. He had been in poor health for several months. He was the grandson of the late J. Edgar Pew, former production vice president for Sun Oil, and was the nephew of the company's present production vice president and production John G. Pew of Philadelphia.

A. W. PEAKE

A. W. Peake, 68, who retired as president of Standard Oil Co. (Indiana) in 1955, died on August 28 at Dundee, Scotland. He had been president 10 years and a director for 25 of the 34 years he served the company. He was associated for nearly four decades with Frank O. Prior, present chairman, and for a decade with Dr. Robert E. Wilson, who retired as chairman early in 1958.

JACK MARTIN

Jack Martin, 38, supervisor of General Geophysical Co.'s Rocky Mountain area, died recently. He had worked in the Rock Mountain area since 1945. Mr. Martin was a native of Rogers, Ark.

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Kendavis International

Widely expanded growth of 19 affiliated companies operating throughout the world recently resulted in formation of a new top-level international management organization known as Kendavis Industries Inc. International. General Headquarters of the new company will be at Forth Worth, Texas. Ken W. Davis is president of the new corporation.

Affiliated companies include: Compania Pionera de Venezuela CA; CP-Harrisburg Inc.; Cummins Sales & Service Inc.; Cummins Sales & Service de Venezuela CA; Dorris Ballew Inc.; Great Western Drilling Co.; six domestic and foreign organizations of the Loffland Bros. group; Mid-Continent Cummins Export Corp.; Mid-Continent Supply Co.; Mid-Continent Supply Co. of Venezuela CA; Pioneer Well Services Ltd.; Stratoflex Inc.; Stratoflex of Canada Inc.; and Unit Rig & Equipment Co.

Vice presidents announced by President Davis included: Ken Davis, Jr., who is chairman of Loffland Bros. and of Unit Rig & Equipment Co.; Thomas N. Shults, who is president of Midcumport and a Mid-Continent vice president; Victor LeMay, Mid-Continent public-relations and advertising director; John W. Tullis, Stratoflex vice president and general manager; R. J. Bromell, Great Western chief engineer; P. Z. Hilliard, Mid-Continent general division manager; Dan D. Rogers, Mid-Continent traffic manager; Walter E. Strittmatter, Mid-Continent assistant treasurer; Jack P. Jones, Mid-Continent personnel and general office manager; Warren Scarborough, Mid-Continent director. Secretary and assistant treasurer is B. L. Coontz, Mid-Continent assistant secretary.

The advisory committee established for Kendavis Industries Inc. International includes: Mid-Continent president D. H. Thornbury, Mid-Continent secretary-treasurer M. C. Cornish, Great Western president R. C. Tucker, Loffland Bros. president R. W. Wire, president Dorris Ballew of Dorris Ballew Inc., Unit Rig president J. L. Vint, Cummins Sales & Service president J. T. Calnon, Stratoflex president C. A. Thomas, Cummins Sales & Service de Venezuela vice president and general manager L. J. Troutz, Loffland Bros. de Venezuela CA vice president and general manager W. F. Ogden, and CP-Harrisburg Inc. president T. P. Tarwater.

Heads Cooper-Bessemer Advertising

Robert S. Warren has been named advertising director for the Cooper-Bessemer Corp., Mt. Vernon, Ohio, to succeed the late Eugene Bonnist. Mr. Warren formerly was with Cooper-Bessemer, first joining the company in 1945. More recently he has been advertising account executive for the company with the Griswold-Eshleman advertising agency, Cleveland. Mr. Bonnist had been advertising director for Cooper-Bessemer for 35 years at the time of his death.

J. T. Calnon

R. S. Warren

Heads Cummins Sales & Service

New president of Cummins Sales & Service, Inc. is J. T. Calnon, formerly vice president sales for the Fort Worth firm. Ken W. Davis, former president, has been elected chairman. Named vice president and general manager was L. J. Troutz, formerly general service manager.

Tarwater Heads CP-Harrisburg Inc.

T. P. Tarwater has been named president of CP-Harrisburg Inc., distributor of specialty oil-field equipment, with headquarters at Fort Worth. Former president Ken W. Davis is now chairman. The company was organized recently as a distributor of the oil-field equipment manufactured by Chicago Pneumatic Tool Co.

Mr. Tarwater was formerly general manager of sales of Mid-Continent Supply Co. R. C. Holden is vice president of CP-Harrisburg Inc. Division managers are J. E. Snoddy, Houston; and C. B. Caldwell, Oklahoma City. W. S. Sease, Fort Worth, is sales manager; and R. F. Timmons, New York, is export sales representative.

Dr. A. C. Goodman

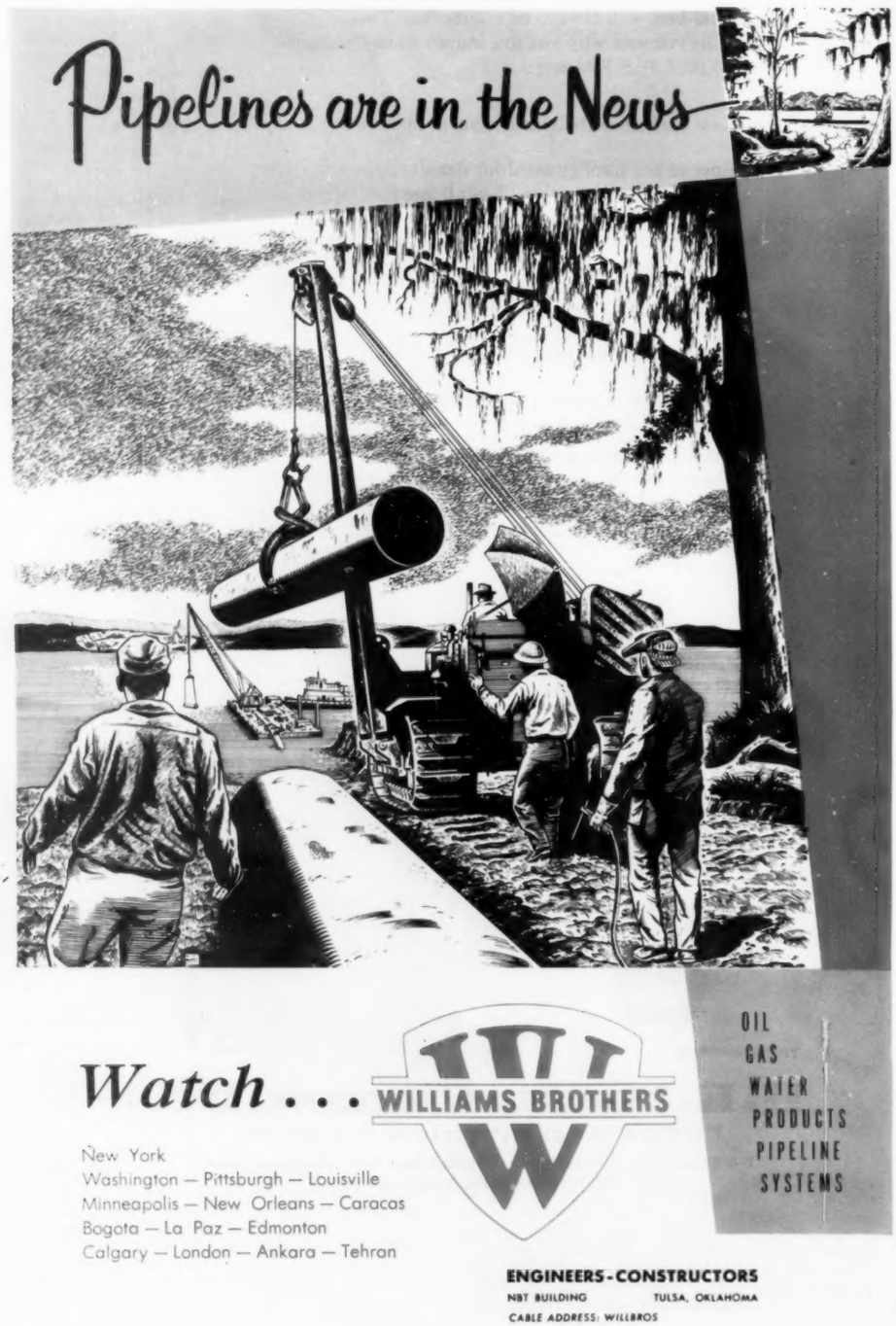
T. P. Tarwater

Schlumberger Gets Goodman

Dr. Clark A. Goodman, nuclear physicist, has been appointed a vice president, and director of the company's research laboratories, for Schlumberger Well Surveying Corp., Houston. Dr. Goodman's most recent association was with the Atomic Energy Commission as assistant director of technical operations, division of reactor development.

Mid-Continent Cummins Export

Ken W. Davis has become chairman of Mid-Continent Cummins Export Corp., worldwide oil-field distributor of Cummins engines. Succeeding Mr. Davis as president of the organization, with headquarters at Fort Worth, is T. N. Shults, New York, vice president of Mid-Continent Supply Co. D. H. Thornbury, president of Mid-Continent, and Jack George, New York, have been named vice presidents of Mid-Continent Cummins Export.



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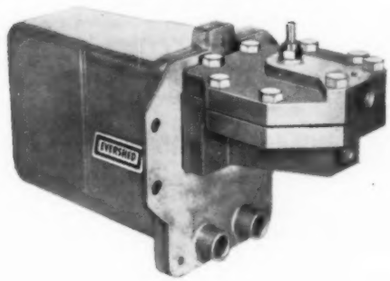

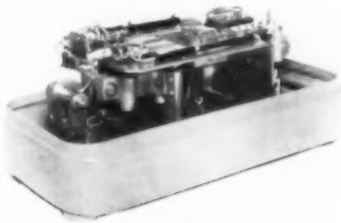

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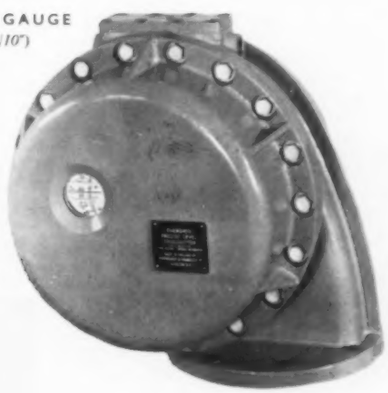

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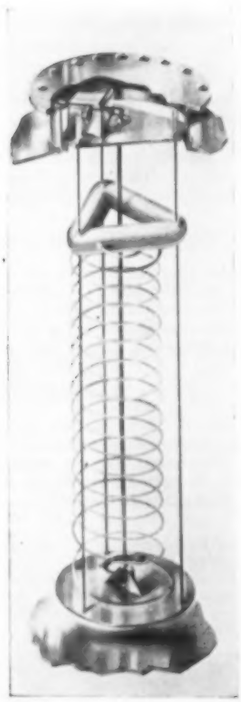

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7/102

W. D. Wilson

W. T. Powell

New PESA Officers

William T. Powell has been elected the new president of Petroleum Equipment Suppliers Assn., Houston, and Wallace D. Wilson, PESA vice president.

Mr. Powell is executive vice president of Continental-Emsco Co., Dallas; and Mr. Wilson is president of Wilson Supply Co., Houston.

Brochure On Sohio Refinery

The new $40 million Standard Oil (Ohio) Toledo refinery is the subject of a new 20-page brochure published by M. W. Kellogg Co. In color and illustrated with photographs and flow sheets, the brochure is divided into eight sections, each describing a different facet of the 60,000 bpsd plant. The Sohio refinery, Kellogg designed and constructed, is the only completely new refinery to be built in this country in over a year.

Copies may be obtained by writing M. W. Kellogg Co. 711 Third Avenue, New York 17, N. Y.

Maher Reed Roller Bit President

Directors of Reed Roller Bit Co., Houston, on August 8 elected a new chairman of the board, a new president, three new directors, and announced the retirement of Rex G. Hamaker as director and president.

Ray O. Shaffer, president of Welex Inc., Fort Worth, was elected a director, and will serve as chairman. John F. Maher, formerly president of Oil Center Tool Co., Houston, was elected a director and president.

A. H. Rowan, chairman of Rowan Drilling Co. of Fort Worth, is the other new director.

Mid-Continent of Venezuela

Named vice president of Mid-Continent Supply Co. of Venezuela CA is John Davis, formerly Caracas manager and New York export manager for Mid-Continent Supply Co. Mr. Davis will help direct the oil-field supply company's operations in the rapidly expanding oil centers of Venezuela.

General Creasy Joins Lummus

Major General William M. Creasy, upon retirement as chief chemical officer, US Army, joined The Lummus Co. at New York, as vice president. He will serve as director of The Lummus Engineering Development Center.

Finuf Moves Up At Beaird

Melvin A. Finuf has ben elevated to the staff of the executive vice president of The J. B. Beaird Co. Inc., Shreveport, La., as marketing assistant—climaxing 23 years of experience in sales, engineering, and production at Beaird.

General Geophysical Co.'s, latest type seismic recording truck which left Houston, Texas, late in September for its 9,272-mile voyage to Dhofar province in the sultanate of Muscat & Oman. Feature of the recording truck is a playback system by which fully corrected on-the-spot record sections can be made.

L. B. Levell

J. H. Kenyon

Heads Mid-Cont Supply Sales

President D. H. Thornbury of Mid-Continent Supply Co. has announced appointment of J. H. Kenyon as sales manager. L. B. Levell, formerly of Denver, has been named assistant sales manager. Mr. Kenyon was formerly assistant general sales manager, and has been with the company since 1947.

Inert-Gas Producing Equipment

A description of the entire line of packaged inert-gas producing equipment manufactured by Southwest Industries Inc., Houston, is contained in a brochure published by the company. In it are included inert-gas generators, nitrogen generators, carbon-dioxide generators, carbon-dioxide removal units, gas purifiers, gas-drying equipment, and compressors and storage systems. The brochure is available from the company at P. O. Box 19392, Houston 24, Texas.

Opens New York Office

The J. B. Beaird Co. Inc., Shreveport, has opened New York offices in the AMF Building on Madison Ave. R. W. Rademacher, formerly manager of plant storage, will be in charge, and will handle both export and eastern domestic sales. The company recently built what are believed to be the world's propane tanks for installation in Venezuela. The vessels store 214,000 gal of propane.

Halliburton Scalechek

Halliburton Oil Well Cementing Co. has announced a new service using SP-2, a compound to inhibit scale crystallization in and on formation faces and tubular goods. The compound is a sodium-calcium polyphosphate with retarded reversion to orthophosphate, lesser tendency to reprecipitation and temperature stability. Placed in the formation in combination with fracturing sand or with oil alone, SP-2 conditions the water in and around the pay zone to check crystal growth.

Reed Roller Bit Changes

B. A. Wendt has been appointed Texas Gulf Coast division manager of Reed Roller Bit Co., with headquarters in Houston—succeeding R. V. Ellis transferred to southeastern division, Louisiana, as division manager. A. A. Ezzell has been promoted to division manager of North Texas division, Wichita Falls. Mr. Ezzell assumes post vacated by the death of J. R. Brandon, Jr.

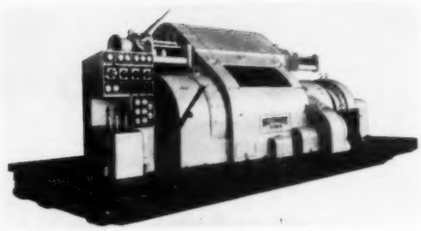
Reed's Kansas and Oklahoma sales divisions, including Texas Panhandle, will be combined into one division with headquarters in Oklahoma City, and W. H. Armstrong will be division manager of combined division. B. F. Hanly becomes area representative in Denver. R. C. Gann has transferred to Casper, Wyo., as division manager of Rocky Mountain division.

Brown Oil Tools Appointment

Appointment of Woodrow Heard as works manager for Brown Oil Tools Inc., Houston, has been announced. He will supervise all manufacturing facilities.

Loffland Hague Office

W. J. Price has been appointed manager of Loffland Bros. Co.'s European operations. Mr. Price formerly was with Loffland as foreign contract representative, devoting much of his time to the Mediterranean area. He will open an office at The Hague.



Medium-Depth Drawworks Drilling

Mid-Continent Supply Co. has incorporated all operating controls into a new single console in its new U-712A drawworks for medium drilling.

This centrally-located panel, equipped with speed-selection levers and air-actuated clutch controls, provides complete control of the rig by the driller with a minimum of effort. It is rated at 700 to 1,200 net input horsepower. The single package unit contains hoisting drum, transmission, rotary drive, and auxiliary brake. It weighs approximately 43,750 lbs. is less than 10 ft wide, and can be easily transported on the highway.

Wheeler At American Iron

W. D. Wheeler, Jr., has been elected vice president in charge of sales at American Iron and Machine Works Co. Inc., of Oklahoma City. Mr. Wheeler was raised in oil country, and has been with American since 1935.

Cement and Mud Bulk Plants

A catalog covering bulk plants, bulk trucks, and correlated equipment utilized in the oil-well cementing field and mud service has been published by Rig Engineers and Fabricators Co. Inc., Houston, Texas.

Heavy-Duty Pumps

A new line of heavy-duty centrifugal pumps for refinery and process service has been announced by Dean Brothers Pumps Inc., Indianapolis, Ind. Capacities range from 25 to 1,000 gpm, with total heads to 650 ft in a pumping temperature range from minus 150 F to plus 850 F.

Two-Way Radio Improvements

An add-on 250/330 watt power package which promises substantial savings to two-way radio owners who need greater communications range is now available from International General Electric, New York. The new General Electric Power-Mate enables users of transmitters in the lower power ranges to upgrade their present systems to as high as 330 watts at half the cost they normally would pay for a complete 330-watt station.

The company also has developed a new compression amplifier which serves as an automatic gain control for remote-control units in two-way radio systems. The unit is designed to equalize audio input and output levels to eliminate "blasting" caused by line variations and to provide a constant high-level output on the "transmit" cycle.

New President Esso Tankers

Creation of a new affiliate, Esso Tankers Inc., has been announced by Standard Oil Co. (N.J.). J. M. B. Howard, who began his career with Jersey on a tanker in 1933, was granted leave of absence as deputy coordinator of transportation to serve as president of new company.

W. J. Price

J. M. B. Howard

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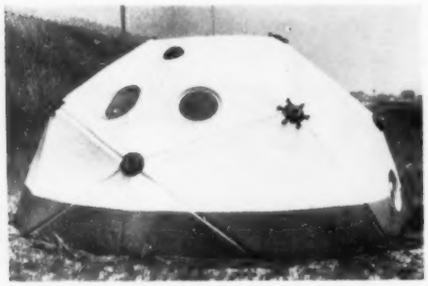

Rear view of the Geodome when erected showing windows, apex valving, ventilation ports, anchor rings and anchor skirt.

New Fluid Loss Additive

Halliburton Oil Well Cementing Co. has announced a new FL-2 additive to control fracturing fluid loss into permeable zones. The additive can be placed in any relatively water-free fracturing fluid, for use with Sandoil or Vis-O-Frac treatments. Laboratory tests show that FL-2 provides an effective temporary seal-off without appreciably affecting the back-flow permeability.

GAI Equipment To Turkey

A half-million dollars worth of geophysical prospecting equipment recently was assembled dockside at the port of Houston, for shipment to Turkey by Geophysical Associates International, Houston. GAI already has one seismograph crew in Turkey, under contract to Socony-Mobil Oil Co. Equipment for oil exploration includes 13 power vehicles and a host of trailers in the forms of offices, workshops, garages, showers, and general storage.

Weight-Dropping For Libya

The McCollum Exploration Co. has established a new district in Tripoli, Libya, and has assigned a geograph crew there, the first weight-dropping "Thumper Crew" ever to operate in that area. District manager there is V. K. Poland.

"Thumper" is a nickname for the "Geograph," a seismic instrument which records sound waves resulting from the dropping of weight.

Lube Members Meet in Chicago

"Lubricating Grease in Industry" is the theme of the National Lubricating Grease Inst.'s 26th annual meeting. Meeting will be in Chicago from October 27-29, at the Edgewater Beach Hotel.

New Home for Little Inch

Little Big Inch Division of Texas Eastern Transmission Corp. moved its headquarters from Shreveport to the Memorial Professional Building, Houston, Texas, as of August 1, 1958.

Richfield Udex Unit Starts

A 3,500 b/d Udex unit has gone onstream at Richfield Oil Corp. refinery at Wilmington, Calif. The unit was licensed, designed, and engineered by Universal Oil Products Co.

Geodesic Portable Housing

A radically new portable housing unit with pneumatic "walls" which can be inflated in five minutes to form a rigid, self-supporting, load-bearing structure has been developed by Berger Brothers Co., New Haven, Conn. It is supported solely by pneumatic panels of neoprene-coated nylon fabric, less than three inches in width. These are inflated simultaneously, but maintain pressure individually, so that once the unit is erected the air pump can be disconnected and the windows and door kept open or closed depending upon climatic conditions.

The unit, called the Geodome, is believed to be the first pneumatic application of the geodesic principle of equalizing stresses, patented by R. Buckminster Fuller. It is so light two men can lift it and yet is sturdy enough to withstand winds up to 120 miles per hour and snow loads up to 30 lb per sq ft.

When deflated, it can be folded to fit into a jeep or small station wagon. It can also be towed by helicopter, either inflated or deflated, to normally inaccessible areas. The Berger Brothers Co. designed the Geodome originally to fill a Department of Defense request for a shelter capable of providing comfortable living quarters under extreme climatic conditions, yet portable, easy to erect and durable.

Two models are currently in production. One has a 16½-ft diameter, 8.3 ft of center headroom, and 218 sq ft of floor area. The second, being constructed for the Air Force, has a diameter of 48 ft, headroom of 24 ft, and floor area of 1,810 sq ft. All the interior space is usable, since there are no poles, ribs, or other supports. Standard size units can be combined in multiples for portable administrative headquarters, sleeping quarters, mess hall, field dispensary or storage shelter. Two 48-ft units can be coupled and equipped with doors large enough to permit trucks or other large vehicles to enter. Units can be immediately detached and dispersed.

Oil Progress Week

American Petroleum Institute has announced the 1958 OIL PROGRESS WEEK will take place October 12 to 18. Central theme of observance is "Today —Oil Builds for Your Tomorrow." Emphasis will be on oil's recognition of its social, civic, and economic responsibilities, and its acceptance of the fact that capital development, to prepare for "tomorrow," may entail $80 billion in decade ending 1958.

Crude Imports Offset By Products

Reductions in crude imports under the voluntary oil-import program have been largely offset by higher imports of refined petroleum products according to Independent Petroleum Assn. of America. IPAA reported that, while crude imports in the May-July period were 230,000 b/d below the same months last year, imports of refined products were up 185,000 b/d. Total new crude supply during the latest three months averaged 8,683,000 b/d—down 843,000 b/d from the corresponding 1957 period. "Domestic production accounted for most of the decline, being down almost 800,000 b/d."

Domestic demand during three months, September-November, is expected to increase 268,000 b/d, or 3.1% above the level for the same period a year ago. Export demand, however, is estimated to decline about 85,000 b/d from 1957 level and average about 270,000 b/d. Thus total domestic and export demand for September-November is expected to average 9,120,000 b/d, 180,000 b/d or 2% higher than this time last year.

Heinemann on European Tour

Dr. Heinz Heinemann of the M. W. Kellogg Co., who is president of the International Congress on Catalysis, on a European tour, presented papers at Liege, France, and Goslar, Germany. He held informal seminars at a number of universities and industrial laboratories. Preliminary plans were made for the next catalysis congress to be held in Paris in 1960.

Tioga Petroleum Formed

Formation of Tioga Petroleum Corp., a Delaware corporation, for purchasing producing oil and gas properties in the USA and in foreign countries, has been announced by John M. King, Tioga president and a partner in King-Stevenson Oil Co., of Chicago.

Composite Christmas Tree

A composite christmas tree has been developed by Cameron Iron Works Inc., of Houston, with suggestions and help from companies associated in the Royal Dutch-Shell group for use in Lage Maracaibo, Venezuela. Trees of this type take up only 20% of the space required by conventional trees of the same pressure rating and size. They provide 10% more flow way because of the oversize bore feature.

Incorporated in this design is a ginpole socket which can be used for maintenance purposes on installation. The tree is so compact that it can be covered completely by a slip-on cover, which reduces materially possible damage due to collision on Lake Maracaibo. The design also makes it possible for the flow line to parallel the casing down to a depth in the lake which will give ample ship clearance and an added safety feature.

Trees of this type in the 3,000 psi working pressure range have been purchased by Asiatic Petroleum Corp. and sold to its associate Compania Shell de Venezuela, to be installed in Lake Maracaibo.

Oil Imports—Pro and Con

THE OIL IMPORT PROBLEM, by Sebastian Raciti, is a study recently published in connection with Fordham University's industrial economics program. It traces the history and background, as well as the rise of the controversial aspects of the present oil imports problem, and objectively details the arguments advanced both by the independents and the majors.

The report concludes with a chapter on "the need for a compromise solution." "Important areas of agreement exist between the majors and the independents," says the author; and, while there is no apparent answer to the problem at present, these areas show a basis for a future solution. ". . . some sort of proratable plan must be made applicable to petroleum imports [similar to nominations used by the USA oil-producing states]. True, when it is found that less oil will be needed, cutbacks can be applied to both domestic and foreign supplies. Conversely, when more oil is needed, foreign petroleum can be increased proportionately to its share in the domestic market. . . . A dynamic situation exists, so any plan would have to be flexible and easily amended," states the report. "Legislation would not be necessary to enforce such a system" if independents and majors agreed to abide by decisions of the regulating agency. Finally, any plan must provide (1) an assured and reasonable supply for the nation; (2) maintenance of adequate and uninterrupted transportation to distant supplies; (3) a sound and healthy domestic industry.

The Oil Import Problem, 100 pages paper-covered, $1.50, is No. 6 in "Studies in Industrial Economics" in heavy industry; published by Fordham University Press, New York (1958).

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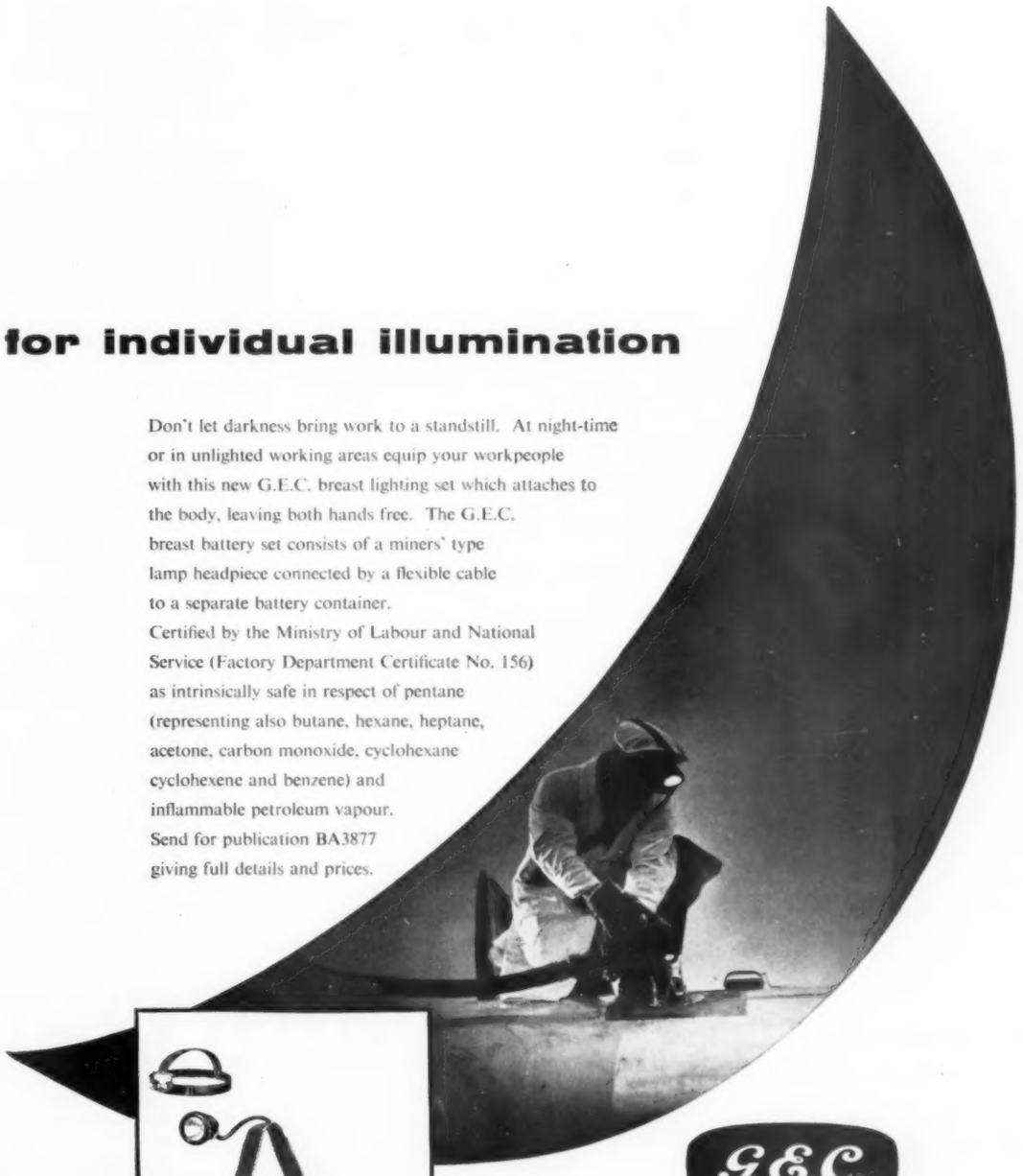

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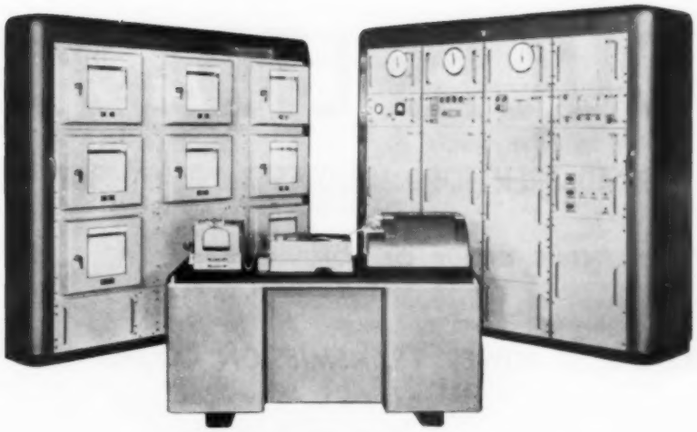

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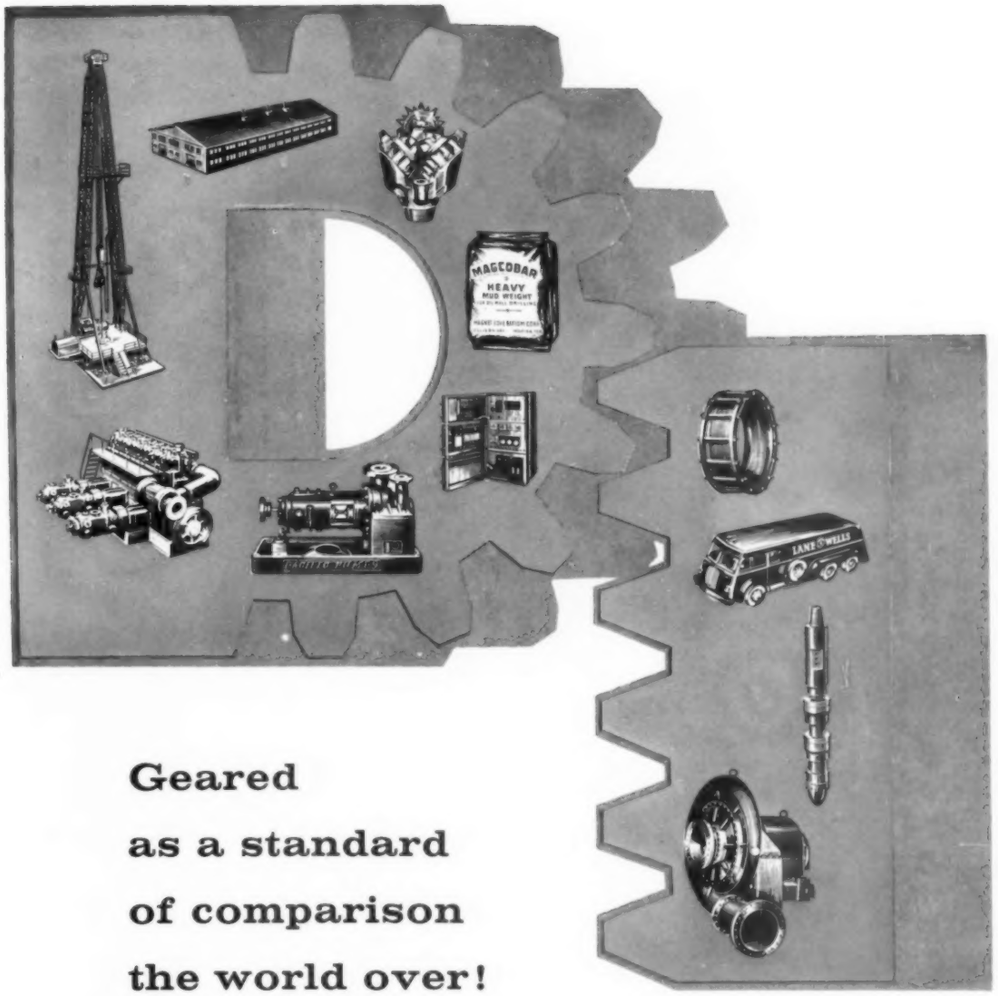

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FREFLO*— a mixture of oil-soluble chemicals designed to remove water blocks in oil and gas wells — by reducing surface tension, attacking interfacial tension and breaking emulsions. 10-gallon drum contains enough for 1000 gallons of treating solution. Available at Dowell stations.

CORBAN*— a complete line of polar-type inhibitors to combat corrosion in oil and gas wells. Available in a number of formulas and concentrations, in both liquid and stick form. Corban is supplied in 10, 20 and 50-gallon drums and in bulk lots at Dowell stations.

MUDBAN*— a non-acid, mud-dispersing agent for removing filter cake from the face of formations, for removing mud lost in formations, and for freeing stuck drill pipe. Recommended for clean-up treatments. Sold in 10-gallon steel drums at Dowell stations

GYPBAN*— a complex phosphate sequestering agent for prolonged protection from production-restricting gyp accumulations— in the formation and on well equipment. Non-toxic and oil-insoluble. Available at Dowell stations in 50-pound fiber cartons.

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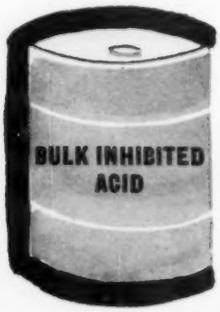
JELFLAKE*— a fragmented, plastic foil added to drilling muds or cement slurries to prevent or stop lost circulation. Particles vary in size for more effectiveness. Packed in strong, wet-proof bags. Available at major mud distributors and Dowell stations.



BULK INHIBITED HYDROCHLORIC ACID — has many uses, including: cleaning scale and gyp from producing formations, tubing and lead lines; cleaning scale from piping, engine jackets, heat exchangers, valves and fittings; dump-job treatments in old wells. Supplied in bulk lots at Dowell stations.

POLYDRIL*— an organic, water-soluble polymer used in clear water drilling for rapid settling of solids. It has increased drilling rates and bit life, and lowered mud costs. Supplied in a semi-liquid, easy-to-use state. Polydril is available at Dowell stations in 5-gallon cans.

PARAFFIN SOLVENT — a non-chlorinated, concentrated, oil-soluble chemical solution designed to dissolve paraffin, even when complicated by asphalt, salt, sand, gum, or wax. Packed in easy-to-handle 10-gallon steel drums. Sold at Dowell stations and major supply stores.